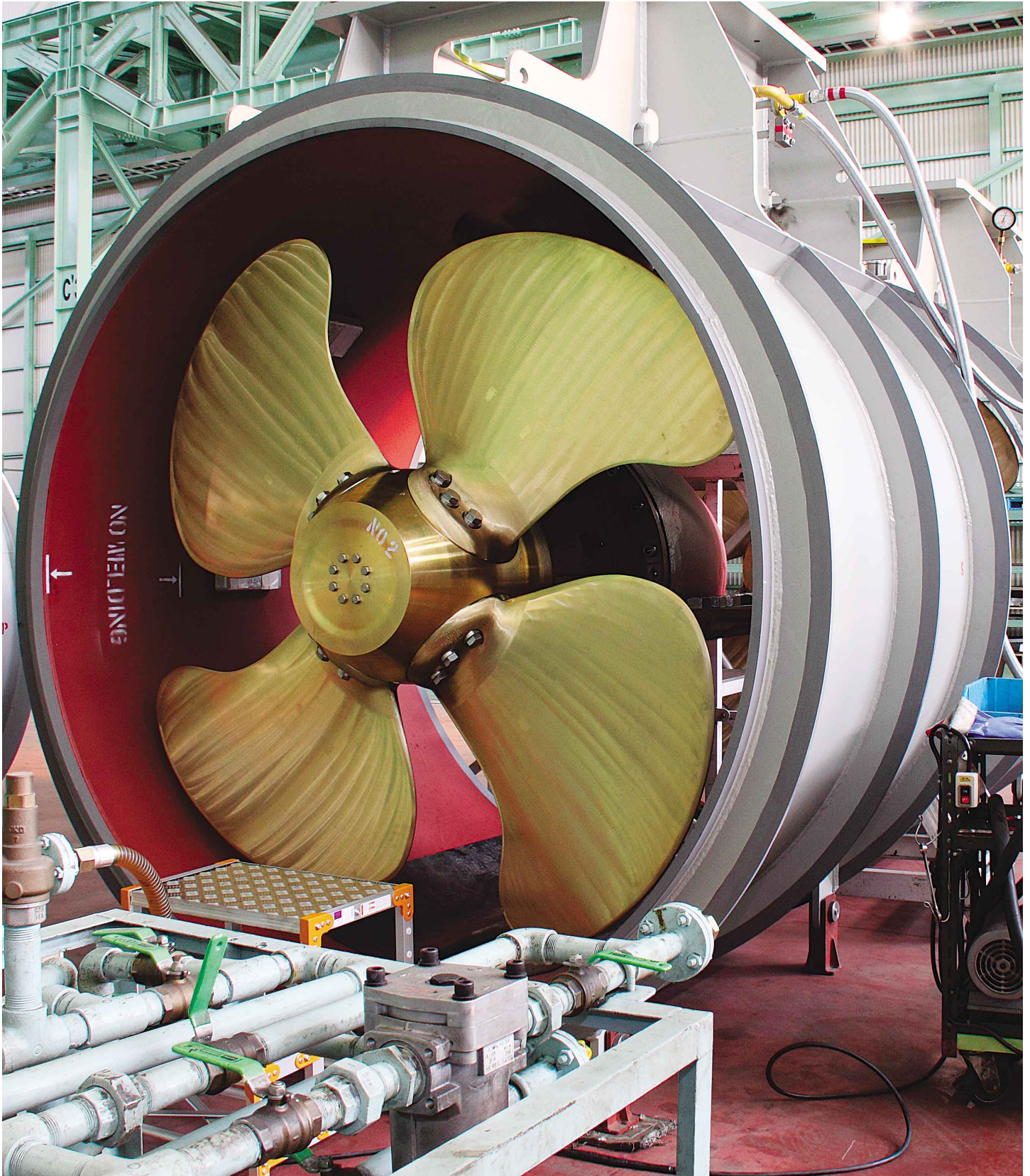


Scope

Kawasaki Heavy Industries Quarterly Newsletter

October 2009

NO.81



in this issue...

Frontline — 2
Behind the Scenes at Kawasaki's Harima
Side Thruster Plant

Technology at Work — 6
K Plant's Concrete Solutions Save Energy
and Boost Performance

Around the World — 8
Singapore's LTA Orders 132 Subway
Cars

Turbocharger Cut-Off Running Mode
for Electronically Controlled Marine
Diesel Engines Launched

BK117C-2 TV News Helicopter
Delivered

Shield Machine for Tokyo's Katsushima
Pumping Station Completed

Nippon Coke & Engineering Orders
Steam Turbine Generator

Two Marine Vessels Delivered

Saving Forest Bears Fruit — 11

About the Cover
Side thrusters produced at KHI's new plant in the
Harima Works.

KAWASAKI HEAVY INDUSTRIES, LTD.

Scope

Editor-in-Chief: Kosei Nishino
Public Relations Department
World Trade Center Bldg., 4-1
Hamamatsu-cho 2-chome, Minato-ku
Tokyo 105-6116, Japan
Phone: 81-3-3435-2132
Fax: 81-3-3432-4759
URL: <http://www.khi.co.jp>

Behind the Scenes at Kawasaki's Harima Side Thruster Plant

All around the world there is a growing demand in the marine market for side thrusters. Given high marks for their superior efficiency, Kawasaki's low-noise, low-vibration side thrusters are at work in a wide range of applications, including passenger ships, ferries and research submersible depot ships. Kawasaki's first dedicated thruster production plant at its Harima Works, which went on line in October 2008, is working to meet the swelling tide of demand across the globe.

This issue's Frontline takes you behind the scenes of side thruster production at Kawasaki, one of the world's top suppliers of side thrusters.



Exterior of Side Thruster Plant No. 1 (total floor area: approximately 10,000 m²), Kawasaki's thriving production base at its new Harima Works home.

Boosting Production Capacity to Supply 40% of the Market

Side Thrusters Give Ships Lateral Push

A side thruster is a propulsion device used for turning or maneuvering a vessel sideways. While many of us have seen a ferry move sideways as it berths or pulls away from its dock, few are aware that this lateral movement is made possible by side thrusters.

Ships generally have a screw propeller with a rudder behind it positioned at their stern that enables them to change direction while sailing. Turning the rudder will expose one side more to the water pressure generated by the spinning

screw. While the screw and rudder can be used to turn a ship once it sets sail, they are virtually useless when it comes to providing the precise lateral movement needed to dock or depart. Traditionally tugboats have been used to help vessels maneuver, by either pushing or towing them when they are docking or departing.

But tugs can be costly and time-consuming. This is where side thrusters are a real advantage, since they enable vessels to move sideways on their own.

A side thruster is typically installed in a tunnel built crosswise into the bow of a ship below the waterline. For this reason it is often called a tunnel thruster. The side thruster shown in the photo has a screw propeller that spins around to create the thrust needed to turn the bow in either direction. Most side thrusters come with a variable pitch propeller, enabling the helmsman to turn the vessel at any angle.

A side thruster (left) is generally installed in a tunnel (right) built into the bow of a ship.





Side thrusters are put through a series of tough tests before they are ready for shipment.

● **Potential Annual Output of 900 Thrusters**

Since side thrusters can be employed by a wide range of vessel types, including container ships and ferries, demand has been rising. The majority of today's side thrusters come mainly from Europe and Japan. Kawasaki is the largest supplier of side thrusters in Japan and enjoys an approximate 30% share of the global market.

In 2008, Kawasaki moved its side thruster production operations from its Kobe Works to the new Side Thruster Plant No. 1 at the Harima Works, with an eye to boosting production capacity. With a floor area of approximately 10,000 m², the new production plant is capable of producing about 500 thrusters per year. That number, combined with the production volume at Kawasaki's Chinese subsidiary, Wuhan Kawasaki Marine

Machinery Co., Ltd., has brought the total production capacity up to approximately 900 thrusters per year and made Kawasaki one of the world's leading side thruster manufacturers. The company has delivered a total of 4,500 side thrusters since it started production back in the 1960's.

● **Efficient U-Shaped Shop Floor Layout**

The production process basically consists of welding, machining and assembly. It all starts with cutting a steel plate. That plate is then bent to form a cylinder and its sides are welded together. This steel cylinder, referred to as a tube, houses the screw propeller. After it's welded with reinforcing ribs, the tube's surface is treated with a rust-proofing agent before finishing. As all this is going on, smaller components are being machine

processed as well.

Once the casing for the bevel gears that power the screw propeller and the pipe fittings are all ready to go, the gears are adjusted so they mesh together perfectly. The procured screw propeller is assembled, adjusted, and checked for variable pitch movement. The final assembly of all components takes place in a large assembly area. The finished product is then put through rigorous operational and pressure tests and its gear case checked for oil leaks prior to being packaged and shipped.

Kawasaki side thrusters come in various sizes with screw propeller diameters measuring from 1 to 3 meters and more. The largest unit weighs almost 25 tons. While they may be big, they are definitely precision products, with some components requiring machining that is accurate to within one-

Wuhan Kawasaki Marine Machinery Contributes to Output

Located along the upper reaches of the Yangtze River, about 1,200 km from the river's mouth, Wuhan is a city in Hubei Province with a population of some 8 million people. The city is home to Wuhan Kawasaki Marine Machinery Co., Ltd. (WKM), a major manufacturer of side thrusters. The company was founded in 1995 as a joint venture between Kawasaki and the Wuhan Marine Machinery Plant, China's leading marine machinery manufacturer, affiliated with what was then the China State Shipbuilding Corporation.

WKM has been riding a tide of good fortune in pace with the rising demand for ships with side thrusters, such as container ships, chemical tankers and various workboats. WKM's sales have been buoyed not only by China's thriving shipbuilding industry but also by its commitment to

quality, which has earned it an excellent reputation in the marketplace. WKM provides its new employees with intensive training to ensure consistent quality. If any problem occurs, the company carries out a thorough investigation and analysis and then takes appropriate action. It is WKM policy to solve any problem that occurs after delivery of a product onsite within 24 hours. WKM does everything it can and offers the best possible solution to keep its customers satisfied. This "quality first" commitment has created tremendous customer confidence in its products.

WKM's factory consists of welding, machining, and assembly/testing shops that are conveniently positioned adjacent to one another. The company runs an extremely tight ship with facilities that are always kept immaculately clean.

The machining shop is equipped with state-of-the-art machining tools including NC (numerically-controlled) machining centers. Many of WKM's employees working in its production plant are state-certified crane operators, welders or other licensed trade professionals. All 200 of its employees are working hard to achieve this year's goal.



WKM factory buildings. Pictured in front is the assembly/testing shop.

hundredth of a millimeter (0.01 mm).

Workstations at Kawasaki's new production plant are laid out in an extremely functional U-shape and placed in the same order as the production process. It takes about two months to complete the entire production process from cutting the steel plate to finished product.

Perhaps the greatest feature of Kawasaki's side thrusters is their compact design, which

makes them easy to install on any vessel. Because they are so small, it is possible to install them in narrow tunnels built closer to the bow and further away from the center of the ship. This position increases torque and significantly enhances ship maneuverability. Kawasaki side thrusters are built to cut noise and vibration while delivering stable performance in either direction.

While the new production facility has increased the shop floor area and boosted production efficiency, Kawasaki is currently working to enhance cost competitiveness and shorten lead-time even further. After laying a firm foundation of expertise, Kawasaki is now aiming to take its side thruster business to new heights with an eye to controlling 40% of the global market.



Steel plates are automatically cut to make tubes that house a screw propeller.



▶ A pressing machine bends the steel plate to form a cylinder (tube).



▶ The tube's sides are welded together with reinforcing ribs.



▶ The bevel gears are fine tuned so they mesh together perfectly.



▶ The screw propeller (cast copper alloy) is assembled. Since it's a variable pitch propeller, the blades can be angled at different degrees.



▶ The gear case is checked for oil leaks. The finished product is then put through rigorous tests before it's packaged and shipped.

K Plant's Concrete Solutions Save Energy and Boost Performance

K Plant's Proven Track Record

Look around you and you are likely to see concrete. You'll find it used in just about every kind of structure, from high-rises and houses to bridges, highways, dams and much more. Concrete is basically a highly durable man-made stone that is composed of a mixture of cement, water and aggregate (sand and gravel). It's a versatile material that's resistant to fire as well as pressure and can be molded into virtually any shape.

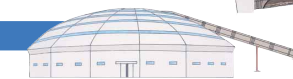
Kawasaki Plant Systems, Ltd. (K Plant), a comprehensive engineering company operating under the umbrella of the Kawasaki Group, has a proven track record of supplying major cement production equipment to the global market for over the last 80 years. K Plant has designed and delivered large energy-efficient, high performance, cement plants to customers around the world. Today the number of cement plants delivered by K Plant stands at 60 and rising.

K Plant's strength lies in its technological capability to produce raw mills, kilns, and cement mills in-house. These are the essential cement production "tools" that hold the key to achieving outstanding cement quality and superior energy efficiency. K Plant also provides comprehensive state-of-the-art cement plant engineering services that makes it a one-stop solutions provider for everything from feasibility studies, process and electrical equipment design, civil engineering, manufacturing, procurement, installation and test-running to training and maintenance.

Crushing and grinding of raw materials

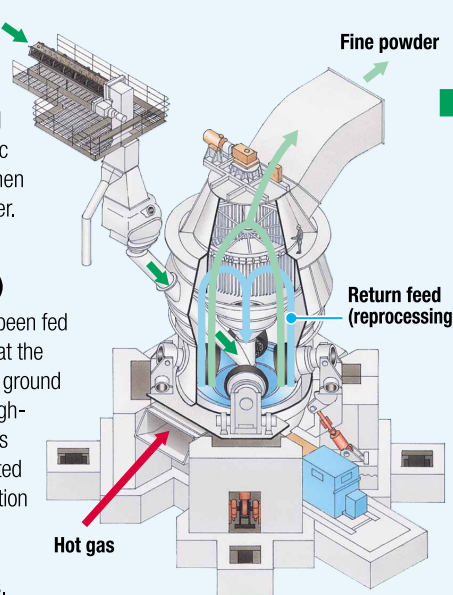


Raw material storage yard



Grinding

The raw materials are mixed together to achieve a specific chemical composition and then dry-ground into a fine powder.



Raw mill (CK Roller Mill)

The raw materials that have been fed onto a rotating table located at the lower part of the raw mill are ground with rollers. Equipped with high-performance rollers as well as a classifier that can be adjusted for any particle size specification desired, the CK Roller Mill is capable of high quality, fine grinding of raw materials.

Recent deliveries made by K Plant



Cam Pha Cement Plant (clinker output: 6,000 t/day), Vietnam, 2008

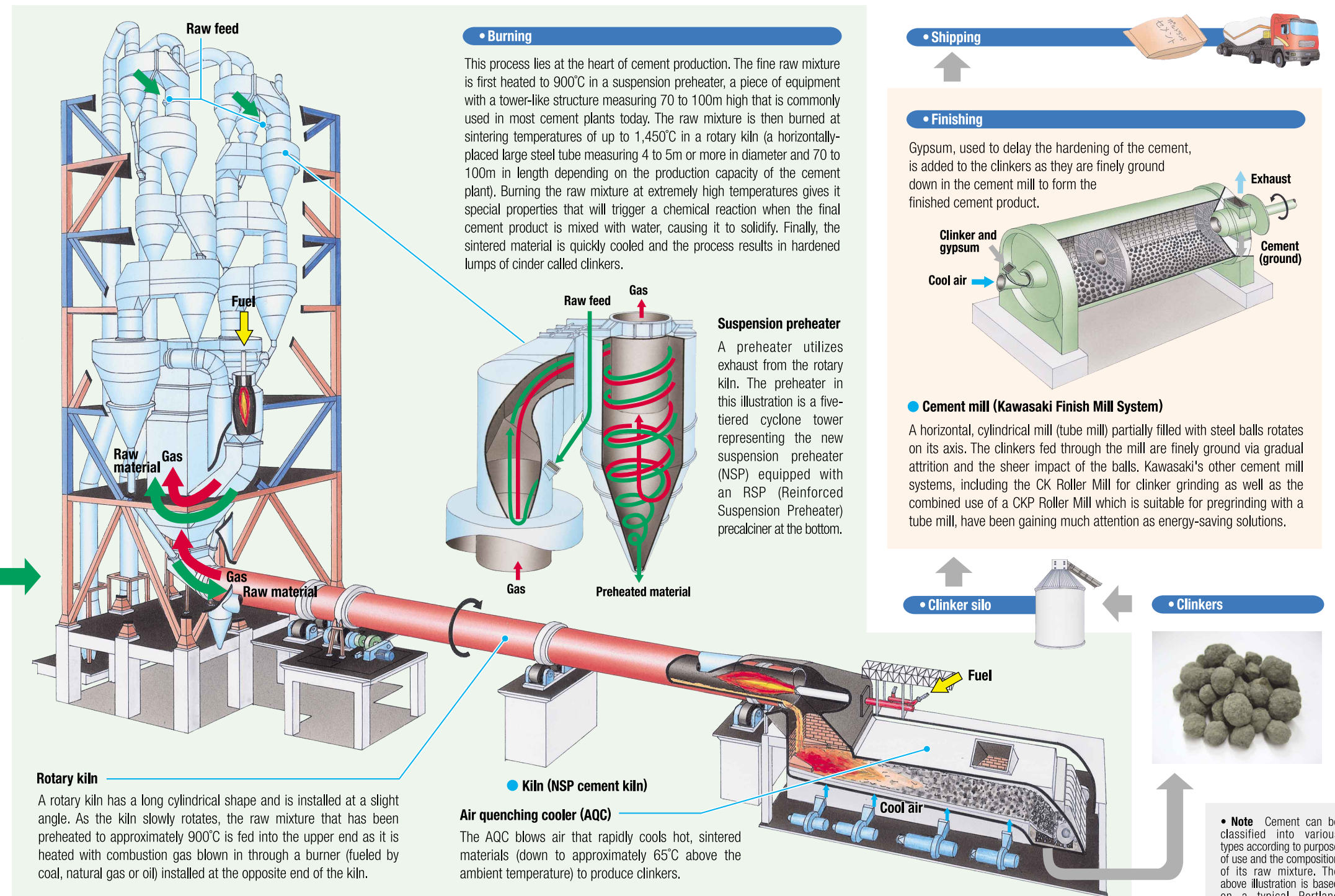


Lafarge Cement Plants (combined clinker output: 4,600 t/day), Morocco, Plant 1 (left) 2004 and Plant 2 (right) 2009



Kelete Cement Plant (clinker output: 3,000 t/day), Turkmenistan, 2005

TECHNOLOGY at WORK



Singapore's LTA Orders 132 Subway Cars

Working in concert with Kawasaki Heavy Industries (Singapore) Pte. Ltd. (KHI-SIN) and CSR Qingdao Sifang Locomotive and Rolling Stock Co., Ltd. (Sifang), Kawasaki recently received a 22 billion yen order from the Land Transport Authority (LTA) of Singapore. The three companies will work together to supply 132 Electric Multiple Unit (EMU) train cars to Singapore's Mass Rapid Transit (MRT) system.

Kawasaki will be responsible for the overall project as well as design and manufacturing of bogies, in addition to procurement of primary components. Sifang will be in charge of manufacturing, final fitting and assembly of complete EMUs, as well as factory testing. KHI-SIN will be responsible for depot delivery of complete EMUs plus onsite testing and commissioning. The new EMU trains are scheduled to be delivered between 2011 and 2012. These new trains will be

deployed on Singapore MRT's existing North-South/East-West Lines, where they will increase rider capacity.

Kawasaki supplied Singapore's MRT with 396 EMU train cars between 1986 and 1989, in addition to another 126 cars between

1999 and 2001. The Singapore LTA awarded this latest contract in light of Kawasaki's project management capabilities, excellent delivery track record, the quality and performance of its EMU trains, and the competitive tender proposal. ::



Turbocharger Cut-Off Running Mode for Electronically Controlled Marine Diesel Engines Launched

Kawasaki recently commercialized the world's first turbocharger cut-off running mode for an electronically controlled marine diesel engine, which reduces fuel oil consumption at part load. This technological breakthrough goes a long way toward solving the problems of mounting CO₂ and other greenhouse gas emissions as well as fluctuating oil prices.

The running mode is designed for a main engine fitted with three or more turbochargers. When the engine is operating at part load, one of the turbochargers is intentionally cut off to increase scavenging air pressure, compression air pressure and maximum combustion pressure. This pressure increase boosts thermal efficiency. The remarkable new running mode pared fuel consumption by up to 4% during onshore testing performed with a Kawasaki-MAN B&W 12K98ME engine in late 2008. The running mode was first installed on Kawasaki K-Line's 8,000 TEU container ship, which went into service in March 2009.

Usually, whenever a main engine's combustion performance is enhanced, there is a surge in flame temperatures that triggers more NO_x emissions. At the same time output from the waste heat recovery system declines due to reduced exhaust gas energy. This new running mode cuts fuel consumption while maintaining steady exhaust gas temperatures

and keeping NO_x emissions within regulatory limits. Optimum exhaust valve timing, fuel injection timing, and adjustment of the exhaust gas bypass rate according to load all work to keep NO_x emissions down. Turbocharger cut-off plates have to be manually installed in the gas lines, but the electronically controlled system's operator-friendly design makes it possible to operate



the mode and make adjustments to the main engine with the touch of a finger. All the engine operator has to do is simply touch the "T/C Cut" switch on the engine control panel.

Kawasaki is working to develop innovative ways to optimize engine performance and vessel energy systems by maximizing the variable control mechanisms on electronically controlled marine diesel engines. ::

BK117C-2 TV News Helicopter Delivered

Kawasaki recently delivered a BK117C-2 helicopter to Eurocopter Japan Co., Ltd., which will equip it with cameras and broadcasting equipment, and deliver it to Fukuoka Broadcasting Corporation. This is the first C-2 model to be used by a television station in Japan.

The BK117 was jointly developed by Kawasaki and Messerschmitt-Bolkow-Blohm (MBB), which is now called Eurocopter Deutschland (ECD). The BK117 is a medium-sized twin-engine multipurpose helicopter that's used for broadcasting, transporting cargo and passengers, firefighting and police and emergency medical services. The helicopter boasts superior safety and operability, a compact body and large double doors in its rear for transporting long objects such as stretchers. Since its market debut in 1983, the BK117 has undergone continuous improvements, and it is the best-selling model in the world. More than 600 helicopters have been delivered worldwide thanks to Kawasaki's outstanding technological know-how and proven track record.

The C-2's ability to easily accommodate



today's increasingly larger media equipment, cover wider flight areas and meet the growing need for enhanced environmental performance makes it the perfect choice for media organizations. The C-2 boasts enhanced flight performance and transport capability with 30% more cabin room, a 7% increase in maximum gross weight and a 30% wider flying range over its predecessors.

It also features a new main rotor blade

design that significantly reduces noise and vibration, a revamped cockpit for better visibility, and an integrated flight instrument system with simpler flight displays to reduce the pilot's workload.

Kawasaki continues to leverage its superior technological capabilities and reliability, as well as prompt customer service, to aggressively market its BK117C-2 helicopters. ::

Shield Machine for Tokyo's Katsushima Pumping Station Completed

Kawasaki recently completed an articulated slurry shield machine with a diameter of 10.3 m. The order for the shield machine came from a joint venture formed by Maeda Corporation, Konoike Construction Co., Ltd. and Nippon Engineering Consultants Co., Ltd. The shield machine will be used for a

Japan Sewage Works Agency construction project commissioned by the Tokyo Metropolitan Government. The ongoing project, involving the excavation of a 980 m stretch of a pumping station inlet sewer, is designed to prevent inundation and improve water quality in Tokyo's waterfront areas.



The slurry shield machine is the world's first 10 m class machine to employ an articulated steering system, which enables it to turn either left or right at up to an 11° angle and to carve out an S-shape curved section with a radius of 30 m. The machine will go into operation this November.

In the face of continuing rapid growth, the Tokyo Metropolitan

Government has been working to boost its pumping station capacity. Modifications to existing stations will enable them to handle increased wastewater and stormwater runoff while the construction of a new station will improve the water quality of Tokyo's waterfront. The slurry shield machine will be used in a construction project designed to take stormwater that now drains into two rivers running through the heart of Tokyo and redirect it to the new pumping station.

Kawasaki has supplied more than 1,400 shield machines and tunnel boring machines (TBMs) around the world. Today it enjoys Japan's largest share of the market, selling over 30% of all shield machines with a diameter of 10 m or more. The road ahead looks bright as Kawasaki continues to carve out an even bigger piece of the global TBM market pie. ::

Nippon Coke & Engineering Orders Steam Turbine Generator

Kawasaki recently received an order for a 16.5 MW steam turbine generator from Nippon Coke & Engineering Co., Ltd. (NCE, formerly Mitsui Mining Co., Ltd.). The steam turbine generator will be delivered to NCE's Kitakyushu Coking Works in Fukuoka Prefecture in April 2011.

The steam turbine generator will be installed in a coke dry quencher (CDQ). The CDQ quenches red-hot coke that has been dried by distillation in a coke oven with inert gas and, recovers sensible heat using a boiler to generate steam for power generation. The

CDQ quenching process occurs in a completely air-tight environment. The thermal energy, which would otherwise dissipate into the ambient environment as vapor with conventional wet quenching methods, can be recovered by the CDQ and used to generate electric power.

Kitakyushu Coking Works, Japan's leading coke producer, currently has one CDQ in operation. It plans to accelerate its efforts to save energy and reduce CO₂ emissions with the implementation of an additional CDQ through a subsidy from Japan's New Energy

and Industrial Technology Development Organization (NEDO).

Since the launch of its first industrial steam turbine in 1956, Kawasaki has delivered more than 330 steam turbine units. Kawasaki has supplied a number of products to NCE in the past, including a coal moisture control plant. This latest order is a testament to the superior performance and lifecycle cost of Kawasaki steam turbines as well as the company's outstanding reliability and proven track record. ::

Two Marine Vessels Delivered

Kawasaki Shipbuilding Corporation has recently delivered two innovative marine vessels. The *Bangkok Highway* pure car carrier (PCC), with a capacity of 5,000 cars, was delivered to KAW1601 Shipping at Nantong COSCO KHI Ship Engineering Co., Ltd. (NACKS) in Nantong, China on May 22. The carrier, identified as Kawasaki hull No. 1601, is the fourth built at NACKS.

The 179.99 m long, roll-on/roll-off PCC has 12 decks, of which three are movable. They can be lifted up or lowered from the ceiling to accommodate mixed loading of different types of vehicles, including buses

and trucks. There are two rampways to facilitate the loading and unloading of large cars driven to/from ports.

To make the ship more eco-friendly, the carrier is powered by an electronically controlled ME engine that optimizes fuel injection patterns and exhaust valve opening/closing timing, by allowing the operator to select either an economy mode that reduces fuel consumption or an emission mode that reduces exhaust emissions.

Kawasaki delivered the *Sakuragawa*, a very large crude oil carrier (VLCC), to

KAW1612 Shipping at its Sakaide Shipyard on June 5. The 315,000 DWT, double-hull tanker marks the 1612nd vessel built by Kawasaki.

Powered by a Kawasaki-MAN B&W 7S80MC-C diesel engine, the vessel features the latest tanker developments, including one of the largest cargo capacities that can pass through the Malacca Straits and enter primary oil tanker berths in Japan. The 332.9 m long carrier is equipped with Kawasaki's rudder bulb system with fins (RBS-F) and high-performance propellers for energy-efficient operations. ::



Bangkok Highway



Sakuragawa

Saving Forest Bears Fruit



In the 18 months since the Kawasaki Group unveiled its new mission statement, *Working as one for the good of the planet*, it has continued many activities devoted to doing just that. Among the environmental conservation efforts already under its belt, Kawasaki can count a deal inked with the Hyogo Prefectural Government, the Taka-cho Municipal Government, and the National Land Afforestation Promotion Organization in December 2008 for an afforestation project in Hyogo Prefecture. The project area, encompassing a 14 hectare stretch of land in Taka-cho, Hyogo Prefecture, has been dubbed the Kawasaki Saidani Nagomino Mori (Kawasaki Saidani Forest Sanctuary).

Under the agreement, Kawasaki employees plant trees, clear underbush, trim tree branches, and perform other forest management activities in Saidani Nagomino Mori as part of Kawasaki's employee environmental training and education. In

addition to this sweat equity, Kawasaki also provides the Hyogo Prefectural Federation of Forest Owners' Cooperative Associations (HPFFOCA) with funds for routine forest management.

Saidani Nagomino Mori is a mixture of cultivated and indigenous broad-leaved forests that have traditionally been an important source of firewood and charcoal. The forests are an integral part of a uniquely Japanese rural landscape that has been cherished by local inhabitants for ages. The first afforestation program, carried out in April, provided about 80 people who work at nearby Kawasaki offices and their families with an opportunity to get some hands-on experience in forest management. The participants were divided into small groups to work on planting and trimming under the careful guidance of HPFFOCA representatives. Everybody found the experience to be extremely rewarding, like the participant who said, "I really worked up a



Kawasaki employees and their families really work up a sweat planting Japanese maple saplings.

sweat but when I look back on the whole thing I get the incredible feeling of a job well done." Many of the kids who worked on the project said they are looking forward to the day that the saplings they planted will grow into huge trees. Another participant seemed to sum it all up for everyone, saying, "Being out here in this natural mountain environment really makes me feel like I'm alive. I'm definitely coming back again."

The program was followed by more environmental training via afforestation activities at Saidani Nagomino Mori later in the month. Twenty-four new employees from the Corporate Technology Division took part in this environmental training program.

Many companies claim that environmental conservation is part of their corporate social responsibility. At Kawasaki, where saving the environment is part of everyone's daily routine, actions speak louder than words. Kawasaki will soon begin involving all employees in regular biannual afforestation activities to take place every spring and fall.



Branches of overgrown trees are trimmed back and bundled together. Forest management is back-breaking work, especially for those who aren't used to it.



Branch trimming went smoothly, bringing light and a fresh breath of air to the forest.

Kawasaki
Let the good times roll.



Ninja ZX-10R
All-Japan Road Race
JSB1000
Team Green
Akira Yanagawa

Ninja – A Tradition of Evolution

In the quarter century since the debut of the iconic brand,
Ninja motorcycles have continually pushed the limits
of accepted conventions – a tradition that will be carried on well into the future.