

Eco-friendly Products and Action Plan

Basic Ideas

As part of our environment friendly activities, we strive to develop eco-friendly products in the following five areas, and have established targets by product.



Examples of eco-friendly products development

Consolidated divisions	Product lines	Areas					Details
		A	B	C	D	E	
Industrial infrastructure	Steel pipes						Water purification
	Iron pipes						Effective utilization of energy; reduction of construction waste soil
	Composite pipes						Utilization of recycled materials; reduction of waste tube generation
	Valves						Weight reduction; reduction of construction waste soil
	Industrial equipment and materials						Fuel consumption reduction; a shift from chemical substances to alternative materials; noise reduction; reduction of construction waste soil; greening
Machinery	Tractors						Easy to dismantle designs; exhaust gas reduction; exhaust noise reduction; operating noise reduction
	Farm machine						Weight reduction; part count reduction
	Agriculture related products						Water pollution prevention; waste recycling
	Agricultural facilities						Reduction of power consumption; water pollution prevention
	Construction machinery						Parts reuse measures; reduction of chemical substance use; exhaust gas reduction; exhaust noise reduction
	Engines						Exhaust gas reduction
	Electric appliances						Energy conservation; power consumption reduction
Environmental engineering	Vending machines						Power consumption reduction
	Clean water and sewerage related products						Power consumption reduction; water purification; waste reduction
	Water environment related products						Water purification; waste reduction; effective utilization of wastes
	Recycling related products						Weight reduction; power consumption reduction; noise and vibration reduction; waste reduction
-	Pumps						Effective energy use; water purification
-	Water treatment tanks						Reduction of construction waste soil; water purification
-	Air-conditioning equipment						Waste reduction; power consumption reduction; reduction of chemical substance use

Environmental labeling

Eco marks

Items	Product name	Consolidated division
Eco Marks	"Bio Green Grass (Biodegradable oil)"	Machinery

Green purchasing – designated procurement items –

Areas	Classification	Items	Kubota's products
Public works	Construction machinery	Construction machinery with emission-controlled engines	Construction machinery
		Low-noise construction machinery	Construction machinery
	Materials (piping materials)	recycled hard PVC pipes for drainage	Recycled 3-layer foamed core PVC pipes
	Construction methods (method of effective use of waste soil in construction)	method of effective use of low quality soil	"Ducpile construction method (rotary-penetration pile method for ductile iron pipes)"
Equipments		Photovoltaic system	"Ecolony"

Industrial Infrastructure Operations

Mechanical joints for steel pipe piles and sheet piles – Mechanical joint of steel pipe piles –

Steel pipe piles and sheet piles for structural foundations used to be weld-jointed at a construction site. However, the welding work was restricted by such parameters as the level of welding skills, the surrounding environment and the weather conditions, and was requiring improvements.

Freed from these restrictions, our mechanical joints reduce the lag in the construction schedule, dramatically shortening work time compared to the weld-joint method. In urban constructions, this type of joint also reduces environmental stress on the surroundings due to lower emissions from trucks and heavy machinery.

1. Product profile

A mechanical joint of steel pipe piles consists of a pin joint and a box joint parts. In a joint process, a circular-arc key attached inside the box joint is first connected to the pin joint, then fitting the circular-arc key into a key slot of the pin joint. Joining process takes approximately 10 minutes. Applicable diameters and plate thickness run between 400 mm and 1,600 mm and between 9 mm and 27 mm, respectively.

2. Features

The mechanical joint of steel pipe piles:

1. Significantly reduce work time compared to weld-bonding. Weather resistance (rain, snow) shortens construction time.
2. Require no special skills or inspection devices, and stabilize the quality of work.
3. Unlike welding, produces no hazardous gases at the site. Shorter construction times can reduce emissions from trucks and heavy machinery, and the load on the surrounding environment.



Pin joint

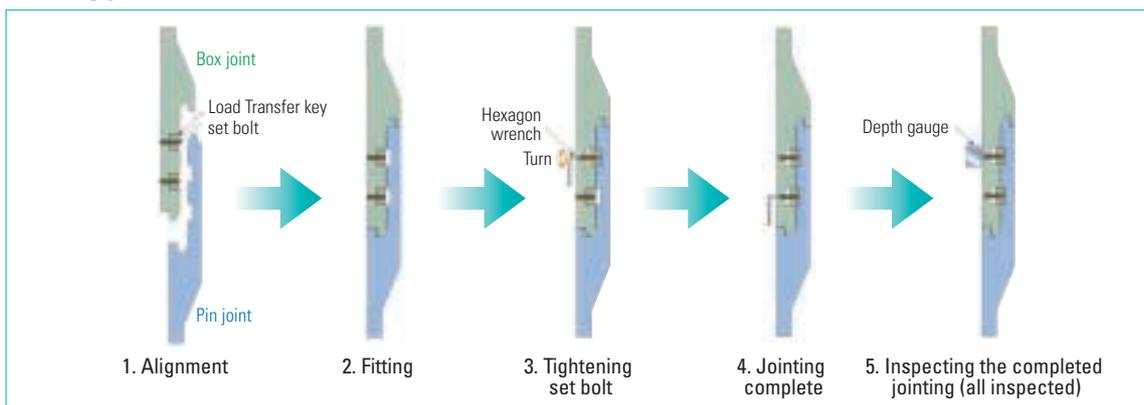


Box joint



Joint construction

Joining process



Advanced emergency shutdown valves

The emergency shutdown valves were developed to prevent leaking of the reservoir water in case water service pipes are damaged by an earthquake and other incidents. The emergency shutdown valves are installed at the outlet of a distribution reservoir to stop the leakage and mitigate any resulting environmental destruction.

Emergency shutdown valves can be broadly divided into the automatic type and the electric signal type. The former detects any abnormal flow speed due to duct damage and automatically shuts down the flow without electric power, and the latter activates emergency shutdown upon receiving abnormal signals from a seismometer or flowmeter.

The advanced model could reduce environmental impact with the following improvements in terms of less resources and space:

1. Reduction in the number of parts based on the simplified structure (reduced 38% in the Company)
2. Weight reduction with limit design (reduced 40% in the Company)
3. Smaller footprint with compact design (reduced 35% in the Company)



Automatic type

Electric-signal type

Cast steel products save energy for industrial furnaces

Iron mills and industrial furnace manufacturers have activated technological development regarding cast steel products to conserve energy and resources and enhance its efficiency, in the hope of lessening environmental stress. This in turn requires sophisticated demand for the materials used in industrial furnaces in terms of functions or performance.

Supported by the wealth of over half a century of experience in the manufacture of heat-resistant cast steel products, Kubota has developed a variety of eco-friendly, heat-resistant cast steel products based on its alloy design and product development concepts focusing on energy and resource savings and recyclability.

For instance, hearth materials (skid buttons) for the slab^{*1} heating furnace at an iron mill must incorporate high heat resistance and compression strength to be able to support slab in the severest operating environment of over 1,300°C. Our chromium-based, high-melting-point skid buttons achieve a dramatically shorter heating time and high yield of steel sheets, reducing the energy and resources needed for the heating furnaces.

Our radiant tubes, a component of an industrial furnace heater, achieve longer service life and energy savings. We work to recover used high alloy steels such as radiant tubes and hearth rolls^{*2}, and promote the recycling of rare metal content by applying re-melting and special refining methods.

* 1 slab: steel ingot before being rolled into steel sheets

* 2 hearth roll: used for continuous heat treatment of thin sheets



Chromium-based, high melting point skid buttons



Finned radiant tube



Hearth roll

Farm and Industrial Machinery Operations

Eco- and human-friendly high power engines with clean emission

For high power compatibility, the V2403-M-T (swirl-chamber-type, IDI) and V2403-M-DI-T (direct-injection-type, DI) are equipped with piston-cooling, double oil jets, tapered piston pin bosses, and an enlarged oil cooler capacity, offering functions to ensure high reliability and durability. These diesel engines satisfy a number of strict emission regulations both at home and abroad, including an emission regulation for special purpose vehicles, and are both user- and eco-friendly products. The diesel engines are equipped in the KL550H Beltion tractors and the ARN460 combine harvesters for professional farmers and form the heart of those product lines.



V2403-M-DI-T
 (Note) V2403-M-T is similar in appearance



ARN460Q



KL550H Beltion

Comments from our engineer

The biggest technical bottleneck eliminated in the development of innovative emission-control technology

After trying many technical approaches, our efforts have resulted in engines we can offer with pride, achieving reliability and durability and managing lower emissions. We have now introduced a new emission evaluation system, and attempt to facilitate an in-house environment for the development of more advanced engines.



Hideyuki Koyama,
 Engine Division
 Engineering Dept.

Low-volume spray with spray volume control technology in conjunction with travel speed

Our ride-type tractor KT22ZQ designed for paddy field work performs pest control and hoeing for rice and soybean fields. Combined with the KBM-500D boom sprayer, the tractor achieves low-volume spraying for rice crops, reducing environmental impact.

In addition to its low-volume spray, the product achieves high adhesion efficiency and controls wider scattering, since chemicals are sprayed from 5-10 cm above the rice plants using its low-drift spray nozzle. This product is a more eco-friendly solution than aerial crop dustings only pursuing labor savings and efficiency.



Low-volume spray demonstration run

Comments from our engineer

Repeated tests in the icy cold paid off!

In development of this tractor, we started with measuring actual travel speed of tractors in a paddy field. The tested soil had low bearing power, and we had a hard time just moving forward in high boots. Braving the piercing cold, we hand-measured the slip ratio, using a peg, measuring tape and stopwatch, over and over again until we collected enough data to calculate the actual speed on the paddy.



Tetsuaki Hayashi,
 R&D Headquarters R&D Dept.

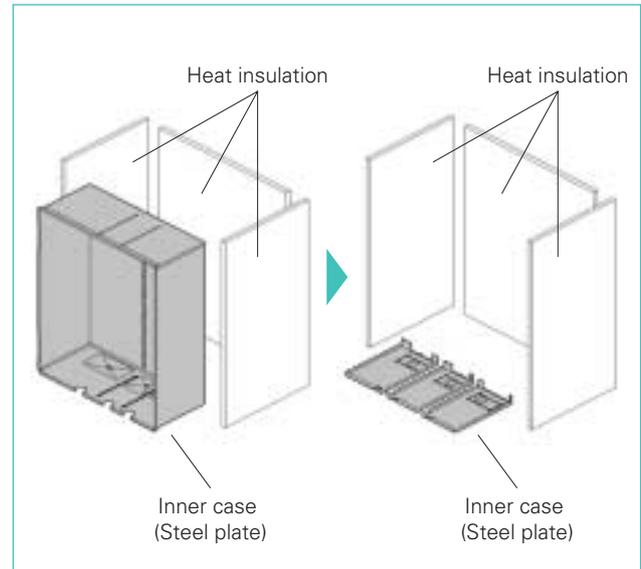
Industry-leading, eco-friendly canned beverage vending machines "30-can Selective Model"

Vending machines are an essential part of Japanese lives. In December 2002, vending machines were determined as a designated machine according to the amended Law concerning the Rational Use of Energy. In fiscal 2005, the law requires vending machine manufacturers to reduce energy consumption by approximately 34% by the end of March 2006, compared to the year 2000 designated model.

With increasing social responsibility, Kubota takes a proactive approach to the development of energy-saving technology. In fiscal 2005, our 30-selection, 4-compartment canned beverage vending machine products lead the industry, outperforming the government-established energy-savings target for the designated machine by 33% with introducing an airflow analysis system which improves cooling, minimizes heat leaks and improves control technology. We implemented a major revamp in the structure of cooling/heating cabinet: reducing the interior cabinet sheet metal area – a major factor in heat leakage – by approximately 90%, and as a result, we have significantly enhanced its thermal insulation performance (top right figure).

To eliminate CFCs, all urethane forming agents were replaced by cyclopentane whose ozone depletion potential is null. We also remain committed to environmental preservation and promote recycling for efficient use of resources and facilitating the separated processing of discarded machine parts.

Eliminating inner case to reduce cabinet sheet metal



Comments from our engineer

We launched a significant target to challenge energy savings and environmental load reductions.

Target for this development project was to reduce power consumption by 5%-8% within a year. It was very challenging since the power consumption had already been slashed in the development of previous models by an average of 32% between 2000 and 2004. Difficult part was that we only had a short time to find solutions to varied issues like improving heat insulation capacity, energy-efficient operation of the refrigerator, and cut the costs. After much trial and error, our team's concerted efforts succeeded in reducing power consumption by an average of 7.5%. Going forward, we will continue to increase energy savings and eliminate CFC-based refrigerants, so we can continue to lead the industry in energy conservation.



Yasuki Chomura,
Vending Machinery Division
Engineering Dept.

Japan's first membrane treatment facility for public sewerage

The first membrane-based sewage treatment plant in Japan has been completed in Fukusaki-cho, Hyogo Prefecture. It is designed to improve the residential living environment and preserve limpid Ichikawa River.

Water treated using the submerged membrane is so clean that it will be recycled back to small streams or used in nearby public rest facilities and for landscaping.

Comments from our engineer

Engineering helps improving the region's environment

We have been engaged in technological development for particular issues, such as improving treatment efficiency, increasing capacity for a large flow rate, maintaining a membrane, and enhancing reliability as a public treatment plant. This technology was developed in a teamwork of many people including me. We hope that we will continue to advance this technology and help improve the region's environment using the advanced technology.



Masatomo Kinoshita,
Water & Sewage
Engineering Dept.



Sewage treatment equipment in the Fukusaki Water Purification Center, Fukusaki-cho, Hyogo
Submerged membranes units installed in reaction chambers

[Plant Description]

Planned quantity of water treated	
Total	: 12,600 m ³ /day
1 st stage	: 21,000 m ³ /day
Effluent water quality:	
BOD	10 mg/liter
T-N	10 mg/liter
T-P	0.5 mg/liter
Used membrane	: Submerged-type
	Nominal pore size 0.4 μm

Composting facility completed

We constructed Eco-kuru Mikata composting facility in Mikata-gun, Fukui Prefecture. The facility is intended to support an eco-friendly agriculture in that area. The facility's roof is covered with transparent plates so that compost transferred in the facility can be fermented by sunshine, natural energy, in sun-drying equipment. Our new compost management system is able to achieve centralized control of temperature, odor and production to ensure stabilized compost production.

Comments from our engineer

The words of gratitude from our customers are a true reward for our efforts.

Our top priority in the process of designing the facility was to consider the environment. We introduced a number of new technologies, including our proprietary deodorizing technology. After its completion, we received appreciative compliments from the customer and local residents saying "good compost and little odor. Thank you for the excellent job."



Fumiji Nakajima,
Waste Engineering Division
Water Environmental
Engineering Dept.



Mihama-Mikata Environmental Sanitation Association
Eco-kuru Mikata Composting Facility

[Facility Description]

Name	: Eco-kuru Mikata Composting Facility
Location	: Mukasa, Mikata-cho, Mikata-gun, Fukui Prefecture
Processing items and capacity	
Livestock waste	: 27 tons/day
Domestic raw garbage	: 3.6 tons/day
Trimmed branches	: 3.5 tons/day
Community effluent and sludge	: 2.2 tons/day

Air Condition Equipment Operations

Wet total heat exchanger efficiently recovers exhaust heat without contaminated supply air

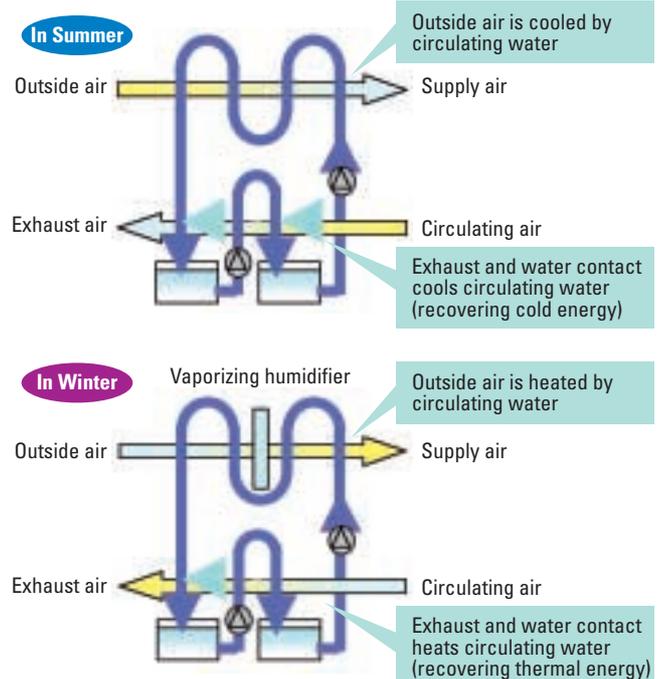
A total heat exchanger is widely used to recover heat from exhaust gas in order to reduce the thermal load on air-conditioning equipment. In animal experimentation laboratories and pharmaceutical and chemical plants, exhaust gases often carry odors and hazardous substances. These exhausts were filtered by the exhaust scrubber and released into the atmosphere without recovering heat, or treated with a contaminant-free total heat exchanger with a 30-40% heat recovery. Kubota combined our expertise in air washer and heat recovery technologies (patent applied for) to devise and bring to market an efficient, contaminant-free wet total heat exchanger.

This wet total heat exchanger, comprised of an air-supply unit and an exhaust unit, promotes heat exchange between supply air and exhaust air by circulating water between both units. By spraying the circulating water directly to the exhaust side, the exhaust gas is purified. At the same time, the exhaust gas is guided past a unique heat exchange medium to drastically boost total heat recovery efficiency. The equipment automatically changes the pattern of water flow and optimizes the humidifier's operation according to the season, which enables to achieve 45-55% heat recovery efficiency throughout the year. Use of a water-to-air heat exchanger prevents supply air from contacting exhaust constituents to keep it free of contaminants. The wider use of this wet total heat exchanger in various types of plants and factories can contribute to save a significant amount of energy in many different industrial sectors.



Wet total heat exchanger

Principle of wet total heat exchange



Comments from our engineer

Our most detailed experiments bore fruit - I'm delighted with it beyond words!

We developed this product by trial and error in the course of thinking, testing and verifying every day. The most efforts were collected to boost heat recovery efficiency. The first prototype failed to achieve a target performance. We increased experiment items in order to make an improvement in detailed or minor areas, and finally satisfied the target after a long-time experiment about changing spraying water amount and improving vapor-liquid contact. We also made changes to the basic structures inside the machine, such as changing wind direction and switching of heat exchange method according to the season in order to achieve high heat recovery performance throughout the seasons. We will keep working to expand industrial clean rooms and chemistry laboratories related markets and increase the application of these products as well as strengthening a cost reduction.



Jun Oshima,
Air Condition Equipment Division
R&D Dept.

Joukaso (Septic Tanks) Operations

Downsized large Joukaso

Large-type Joukaso, which is used to purify domestic wastewater at mid- and large-sized facilities, are often installed in areas where public sewage systems are not available. We have added the K-HC-R ultra-compact Joukaso to our product lines. This product is equipped with a new flow control method and fluidizing-carriers-filtration method in secondary treatment process, which enables to shorten the total length of the tank to 51-64% of conventional models, while tripling the wastewater treatment capacity. This technology drastically reduces the use of raw materials such as fiber-reinforced plastic (FRP), and construction materials and residual soil for civil engineering work. The model K-HC-T features a low gross yield sludge coefficient of 36%, with slashing sludge production to 60% of conventional tanks. This substantially reduces costs and energy consumption associated with sludge disposal. Utilizing a smaller footprint and excellent treatment methods, this product is an eco-friendly product that contributes to the aqueous environment as well as reduce CO₂ emissions and waste generation.

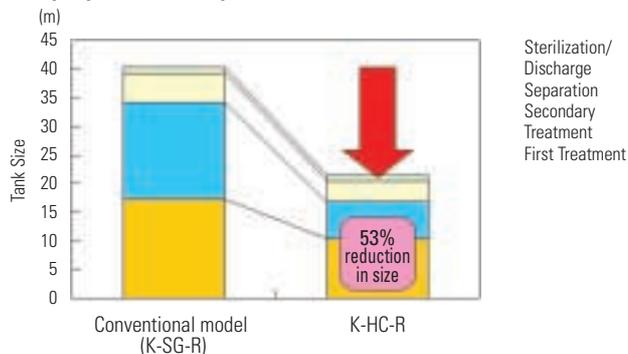


Joukaso installed in a hotel in Saga Prefecture
K-HC-R2: 436 people, 88 m³/day
(flow control tank + concentrated sludge tank)

Structural Drawing (K-HC-R1)



Comparing the K-HC-R with the conventional model (500 people, 100 m³/day)



Carriers for filtration
Smooth surface cylinder Fluidizing carriers

Comments from our engineer

Optimizing the design of septic tanks for manufacturing factories based on wastewater discharge volume and future direction of product development.

Downsizing the tank helped us to reduce materials (FRP) costs for the outer tank as well as the amount of residual soil produced after burying the tank. In addition, the maximum wastewater treatment capacity of this model has been increased from 138 m³/day to 395 m³/day. We devoted a lot of time and efforts to design and selection of proper internal parts and incidental equipment such as blowers in line with an increase in waste water discharge. Needless to say, fewer parts make the better whole, but were we to pursue a “the-greater-serves-for-the-lesser” approach alone? It could cause wasted money and energy in the development of “eco-friendly” product, so that careful consideration was required in the design process. We’ll continue to focus on a reduction in maintenance costs, particularly relating to power consumption and sludge production, aiming at lowering the environmental load of the Joukaso.



Miki Yabuno,
Septic Tanks Division
Engineering Dept.