

Initiatives to Ensure Environment-friendliness in Plastic Pipes

Plastic pipes play a key role in society in a variety of critical applications, for example water supply, sewage, agriculture water, and building utilities.

■ Initiative to Ensure Environment-friendliness in Sewage-related Products at Each Stage of the Life Cycle

Efforts to save energy and resources at each lifecycle stage involve the development of products and engineering methods with superior workability.

[1] Ribbed Pipe

VU pipe which is made from unplasticized polyvinyl chloride (PVC-U) and has thin wall is very popular in Japanese sewage system, since they are low costs, durable and easy to install.



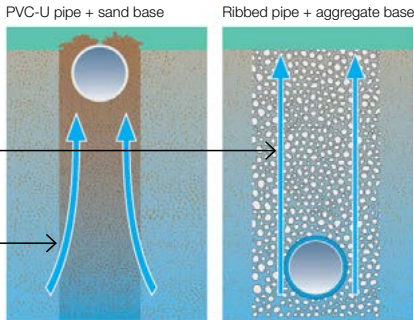
Ribbed pipes supplied by the Kubota Group differ from standard PVC-U pipes because they are thinner but are protected by circular outer ribs. They make the pipes lighter and easier to handle, while ensuring high flattening strength,* and they contribute to conserving resources.



Outer ribbed structure

* Ability to resist deformation under pressure

Environmental Contribution of Ribbed Pipes at Each Lifecycle Stage

Lifecycle	Product feature	Environmental contribution
Production	Thin-walled	<ul style="list-style-type: none"> Amount of plastic raw material: resin, reduced to about two-thirds (compared to the Kubota Group's PVC-U pipes).
Installation	Lightweight	<ul style="list-style-type: none"> Reducing need for heavy machinery to transport, leading to low consumption.  <p>Carrying ribbed pipes</p>
	Superior flattening strength (approx. 1.5–2.0x the Kubota Group's PVC-U pipes)	<ul style="list-style-type: none"> Shallower installation, reducing need for heavy machinery and fuel consumption.
	Ribbed structure	<ul style="list-style-type: none"> Besides sand or gravel, resource recycling material such as recycled sand and gravel, and sludge molten slag can be used as base materials.  <p>Installation of ribbed pipe</p> <p>Base materials</p> <p>Recycled gravel Recycled sand Sludge molten slag Coal ash (clinker ash) Improved soil</p> <p>Possible base materials for ribbed pipe</p>
Usage	Ribbed structure (with gravel base material)	<ul style="list-style-type: none"> Using a porous material such as gravel as the base material can reduce the surge of groundwater pressure due to ground liquefaction during an earthquake, preventing pipe upheaval, breakage or disconnection.  <p>PVC-U pipe + sand base Ribbed pipe + aggregate base</p> <p>Water passes through porous layer, preventing pressure increase and suppressing pipeline floating</p> <p>Rising water pressure pushes pipeline up</p> <p>Ground liquefaction countermeasures by ribbed pipe</p>
Disposal	Recyclability	<ul style="list-style-type: none"> A recycling system to improve the recycling rate of ribbed plastic pipes has been constructed by the Plastic Rib Pipe Association.

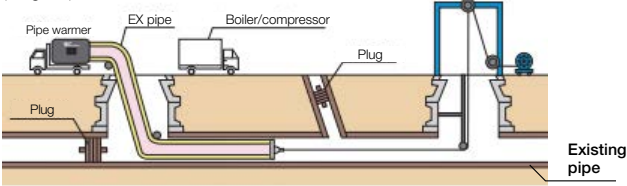
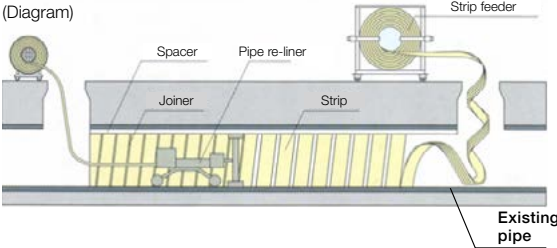
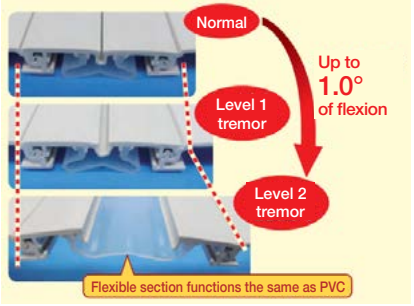
[2] Pipeline Renovation Methods

Around 3% of Japan's sewage pipe network (about 470,000 km at end-March 2017*) is older than its standard 50-year operating life. This figure is forecasted to increase rapidly, to about 12% in 10 years and about 30% in 20 years.

The Kubota Group uses the proprietary non-open-wt method "EX" or "Danby" pipeline renovation methods to insert unplasticized polyvinyl chloride pipe materials into the existing pipe via manholes to renovate the pipe network. This approach helps save energy and materials.

* Source: Ministry of Land, Infrastructure, Transport and Tourism website

Environmental Contribution of Pipeline Renovation Methods at Each Lifecycle Stage

Lifecycle	Product feature	Environmental contribution
Installation	No open-wt required	<ul style="list-style-type: none"> • Less need for heavy excavation machine, reducing fuel consumption • No excavated wastes generated • Less local traffic disruption <p>[EX method] EX pipe is inserted into existing pipe, using steam to expand a pipe and create a seamless contact.</p> <p>(Diagram)</p>  <p>Note: For nominal diameters of 150–600 mm (single pipe 150–400 mm, dual-layer pipe 150–600 mm)</p> <p>[Danby method] Spiral-wound unplasticized polyvinyl chloride strips are installed into the existing pipe using a specialized machine and pieced together with joint materials (Joiner).</p> <p>(Diagram)</p>  <p>Operation with a pipe re-liner</p> <p>Note: For large-scale pipes with nominal diameters of 800–3,000 mm</p>
		<ul style="list-style-type: none"> • Proprietary joint material (SF joiners) with the midsection and flexible section help absorb and can flexibly cope with any bending or deformation caused by an earthquake.  <p>SF joiner deformation in an earthquake</p> <p>Flexible section functions the same as PVC</p>
Usage	High seismic resistance	
	Extend product life	<ul style="list-style-type: none"> • Renovates corroded pipe sections, extending product life by further 50 years.

■ Initiatives to Ensure Environment-friendliness in Agricultural Water Product

We contribute to reduction of water consumption and abnormal weather impact by using pipelines for agricultural water and water management systems.

[1] Using Pipelines for Agricultural Water Supply

Conventional open water channels require considerable maintenance, such as keeping grass under control and water channels clear. Over time, aging water channels can also leak and lead to ineffective water outflow.* Natural pressure pipelines made with our PVC-U pipes and related products minimize maintenance work and reduce water consumption.

The Kubota Group's range of PVC pipes and joints, valves, air valves and other products are used widely in Japan's network of roughly 7,500 km of agricultural pipelines.

* Occurs when water flows into fields even when water is not required.



Pipes being buried in an open water channels

Environmental Contribution of Pipelines

Item	Reduce water consumption	Respond to abnormal weather conditions
Details	<p>Leaks and ineffective outflow are less likely to occur, ensuring reliable supply of water at the required volume and the required time.</p>	<p>During droughts, water supply controlling is used to supply only the shortfall in water; during heavy rain, the valves and overflow outlets controlling is used to manage water as appropriate.</p>

[2] WATARAS* – Farm Water Management System

WATARAS is Japan's first farm water management system that allows users to remotely and automatically control water inflow and outflow for rice fields and monitor water levels with a smartphone or PC.

At Japan's National Agriculture and Food Research Organization (NARO), where the system underwent testing, WATARAS helped to cut water consumption and reduced time spent on water management by roughly 80%. Water management typically accounts for around 30% of all working hours in rice cultivation.

* System developed by Kubota ChemiX Co., Ltd. using technology proposed and developed by national research and development agency NARO as part of a Strategic Innovation Promotion Program (SIP) to create next-generation agricultural technology.

Environmental Contribution of WATARAS

Item	Reduce water consumption	Respond to abnormal weather conditions
Details	<p>Reduces water consumption by around 50% during the period from sprouting season to harvesting season.</p>	<p>During torrential downpours and other short periods of heavy rain that raise the risk of river flooding, farmers can remotely increase paddy field water level to temporarily hold water in fields.</p>

