The Evolution of Environment-friendly Products and Services

The Evolution of Iron Pipes

In almost 120 years of history since becoming the first company in Japan to successfully manufacture cast-iron pipe in 1893, the Kubota Group has succeeded at developing several technologies, including manufacturing technologies for ductile cast-iron pipe with a perseverance equivalent to that of steel, earthquake-resistant technology for pipelines, and long-life external surface corrosion-resistant technology. Our efforts have contributed to resource conservation by reducing pipe weight, reducing the percentage of water leaked by minimizing the number of pipeline breakages, and further resource conservation through making pipelines with a long service life.

<History of Cast-Iron Pipes and Ductile Iron Pipes>

<table>
<tr><th>Year</th><th>Topics</th><th>Pipe material</th><th>Manufacturing method (casting method)</th><th>Mass per length of pipeline*</th></tr>
<tr><td>1893</td><td>Started manufacturing normal cast-iron pipe</td><td rowspan="2">Flakey graphite cast-iron</td><td rowspan="4">Sand mold casting process (matching molds)
Blow-forming casting process
Sand mold centrifugal force casting process
Mold centrifugal force casting process</td><td>1.00 (Standard)</td></tr>
<tr><td>1933</td><td>Development of premium cast-iron pipe</td><td>0.68</td></tr>
<tr><td>1954</td><td>Development of ductile iron pipe</td><td rowspan="3">Spheroidal graphite cast-iron (ductile cast-iron)</td><td>0.39</td></tr>
<tr><td>1974</td><td>Development of earthquake-resistant ductile iron pipe</td><td rowspan="2">Blow-forming casting process
Sand resin mold centrifugal force casting process
Mold centrifugal force casting process</td><td>0.41
(59% weight reduction)</td></tr>
<tr><td>2010</td><td>Development of long-life external surface corrosion-resistant coating</td><td>-</td></tr>
</table>

* When comparing the torso portion of straight pipe with a nominal dia. of DN500

Saving Resources by Reducing Pipe Weight

The Kubota Group succeeded in changing the material of its iron pipes from flakey graphite cast-iron to stronger spheroidal graphite cast-iron (ductile cast-iron) using an independent manufacturing method. This enabled the development of thinner pipes. Consequently, pipe weight has been reduced by 59%, which contributes to resource conservation.

Reducing the Percentage of Water Leakage by Minimizing the Number of Pipeline Breakages

Ductile cast-iron is strong against distortion and impact. Therefore its adoption has reduced the number of breakages in pipelines located under public roads and subjected to severe external load due to factors such as a dramatic increase in traffic and heavier trucks. This, in turn, contributes to reducing the percentage of water leaking from pipes.

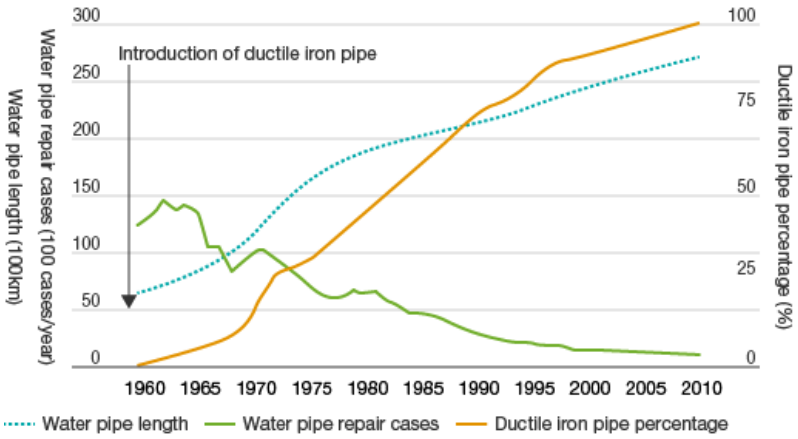
From the period of rapid economic growth onwards

- Dramatic increase in traffic
- Heavier trucks

Water pipes must be able to withstand severe external load.

Source: Japan Ductile Iron Pipe Association

Bureau of Waterworks' Water Pipe Length, Water Pipe Repair Case, and Ductile Iron Pipe Percentage

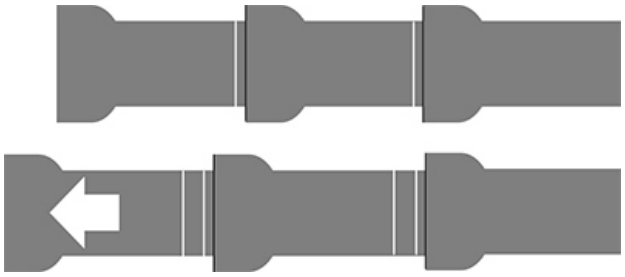


Source: *From Right, From Left*, Kazunori Kawakita, former Director General of the Bureau of Waterworks.

Creating Water Pipe Lines Strong against Earthquakes through the Development of Earthquake-Resistant Joints

The Kubota Group has developed earthquake-resistant joints enabling entire pipelines to absorb any ground movement, thereby protecting water pipelines from earthquakes and helping to achieve a longer service life. The effectiveness of our earthquake-resistant joints has been verified at the time of many earthquakes, including the Great Hanshin-Awaji Earthquake of 1995 and the Great East Japan Earthquake of 2011.

Pipeline Earthquake-Resistant Mechanism using Earthquake-Resistant Joints

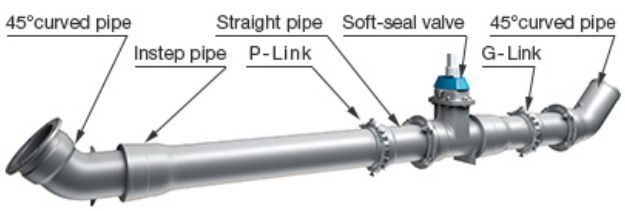


- When one joint stretches to its limit, it pulls on the adjacent pipe, and then the next joint is stretched.
- The joints stretch, shrink and bend one after the next, enabling the entire pipeline to absorb ground displacement, thus avoiding damage.

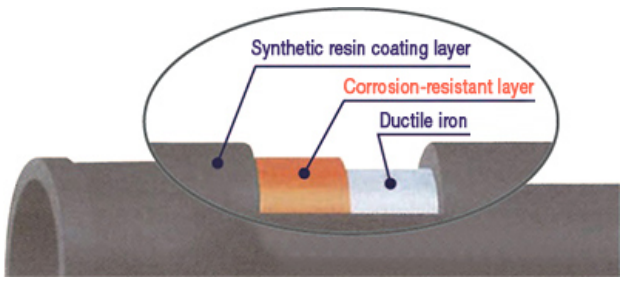
Hoisting test for a ductile iron pipe using earthquake-resistant joints

Achieving Longer Service Life of Pipelines and Contributing to Resource Conservation through the Development of Corrosion-Resistant Iron Pipes

In 2010, the Kubota Group developed the "C-Protect", an external corrosion-resistant coating developed to realize a longer service life, and applied it to the earthquake-resistant ductile iron pipe (GENEX). This has made the pipe strong against earthquakes and even more resistant to corrosion, thereby further contributing to resource conservation.



GENEX® (GX) pipeline example



External corrosion-resistant coating C-Protect (conceptual image)