

Technology for improving energy efficiency of heat exchangers

Features

What is Kurita Dropwise Technology?

- ◆ Primary applications
 - Improved productivity & energy savings (CO₂ emissions reduction) are achieved via improvement to the heat transfer coefficient of exchangers utilizing steam.
 - The overall heat transfer coefficient (U value), an index representing the ease of heat transfer over the entire heat exchanger, is improved by up to 30% based on our testing.
- ◆ Highly versatile
 - The technology is effective on any condensation heat transfer surfaces, regardless of type.
 - The technology can be applied not only to new installations, but also heat exchangers of existing installations.
 - The technology is easily implemented, without mutually interfering with the existing water treatment systems nor requiring modifications.
 - Numerous implementations have been facilitated for water-steam cycle systems of medium to high-pressure boilers that utilize steam turbines.
- ◆ How the technology is provided
 - The technology is provided as a package in chemicals, equipment and analyses.
 - The technology can be provided by subsidiaries of Kurita Group, domestically and overseas.
- ◆ Decarbonization technology
 - The fuel consumption rate is improved by boosting energy efficiency.



Improved heat transfer



Improved productivity



Energy saving

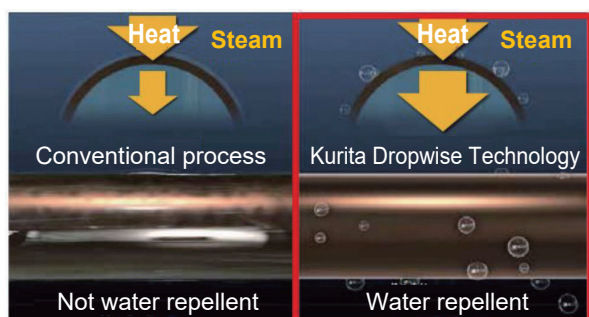
Basic Concept or Summary

◆ Basic Concept

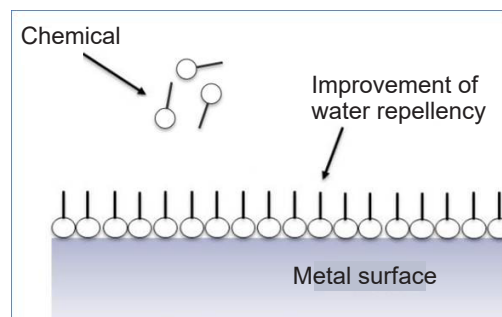
Heat exchangers using steam generated from boilers form a water film due to the condensate on the metal surface on the steam side. This water film significantly reduces the heat transfer efficiency even if the thickness is minimal, and leads to an increase in the amount of steam, thereby consuming more energy and reducing productivity. The dropwise technology is a droplet condensation technology that enables water repellency of metal surfaces on heat exchangers while eliminating the water film to improve the heat transfer efficiency, boost productivity, and save energy via reduced steam consumption.

◆ Principle

Special chemicals mixed into the steam are absorbed onto the metal's surface in order to increase the water repellency and transform the mode of condensation from the film to droplets. The heat transfer efficiency is improved as the water film, which forms a thermal barrier, is removed. This technology, therefore, can be applied while the production facility continues to operate without production downtime.



Droplet condensation increases heat transfer efficiency



Special chemicals produce water repellency on metal surfaces

◆ Three steps for implementing our technology

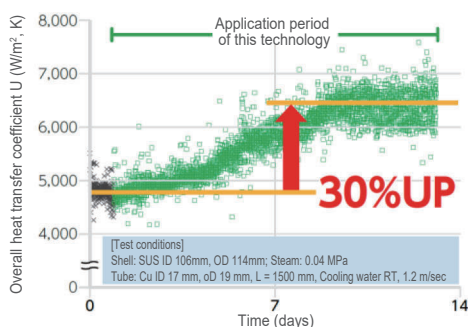
- ① Current conditions data analysis:
The current conditions of the target facility are diagnosed (narrowing down the facility type and verification of operating conditions)
- ② Verification of the effectiveness for the target facility:
Technology implementation (operational adjustments for optimization, etc.)
- ③ Full-scale adoption:
The level of improvements in energy efficiency diagnoses are conducted, with a relevant report submitted.

◆ Laboratory verification results

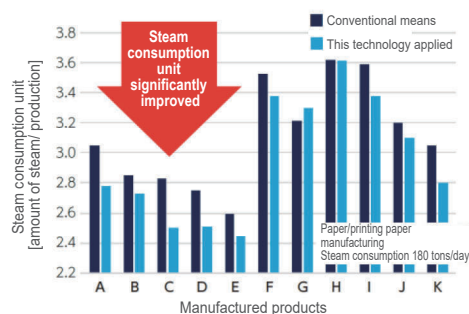
The laboratory verification results of this technology indicated an elevation of the U value as soon as the application of the technology began (first day) and the trend continued through to the ninth day. The U value in this instance increased by 30%. A transition from the film condensation to the droplet condensation was also visually observed on the heat exchanger surface as the U value increased.

◆ Examples of application on actual equipment

This is an example of the heat transfer efficiency in the dryer process at a paper mill, improved by applying this technology, which led to a maximum improvement of steam consumption (amount of steam and production) by 8%. The improvement rate of steam consumption at the facilities that implemented this technology frequently reached 5% to 10%.



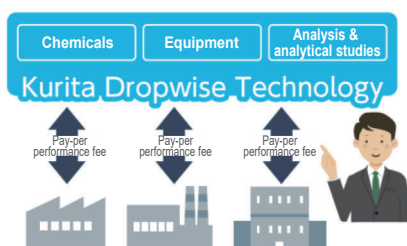
Laboratory verification result
(Shell-and-tube type heat exchanger)



Example of application on actual equipment
(Drum dryer)

◆ The 2019 Energy Conservation Grand Prize (Product and Business Model Division) of the Agency of Natural Resources and Energy Commissioner's Award.

This technology is offered in packaged contracts that provide the technology to a multitude of users, across all boundaries of industries.



Product & Business Model Division Award

Installation in Practice or Schedule

- Domestic**
- Drum dryers (dryer processes at paper mills, etc.), steam turbine condensers, reaction kettles, etc.
- Overseas**
- Drum dryers (dryer processes at paper mills, etc.), steam turbine condensers, reaction kettles, press machines, etc.
 - Since the market launch in 2017, this technology has been implemented at over 400 facilities around the world.
 - This technology is supplied globally to water treatment chemical businesses in areas specified in the figure below.



Source: https://www.kurita.co.jp/aboutus/gn_overseas.html

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