

S challenge for innovation
HISAKA WORKS, LTD. Heat Exchanger Div.

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Hisaka Works, Ltd., Heat Exchanger Division, is ISO9001 certified for its quality management system for all products including plate heat exchangers.

Hisaka Works, Ltd., is ISO14001 certified for its environmental management system.

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Agent



For energy saving

We would like to generate profits on our customers in all of Asia and us more than before, making repeatedly various proposals how to save energy with our HEX.

For being it, there is a great catalogue needed.

Here is to show you an idea to make the catalogue for energy saving.

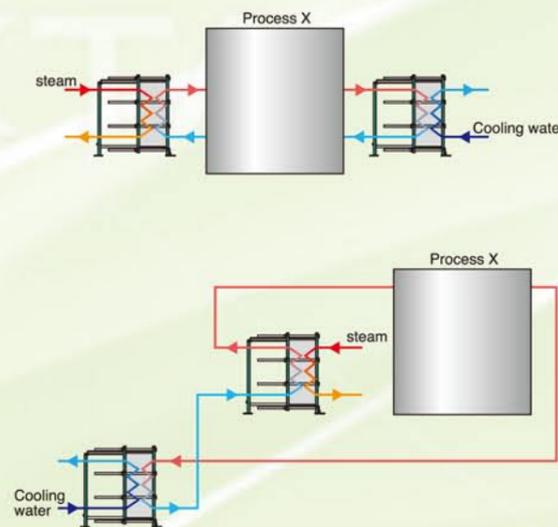
We appreciate your marketing team.

Let's see the idea!



Create the Infinity loop

The most simple method of the heat recovery is to create the Infinity loop. When there are two individual streams of fluids, one is to be heated up and the other is to be cooled down, we can change the its circulation of these streams as "Infinity ∞", so that we can improve this process successfully. We can save the consumption of steam and cooling water as well.

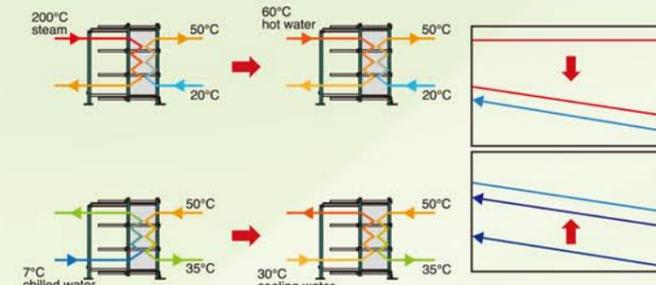


P4,5,8,10,11,13 GO!



Consider heating and/or cooling resource

When heat up and/or cool down the stream, it is very meaningful to check and consider which energy resource to be used. To be found another resource which temperature is closer as much as possible. Better not to use higher potential energy resource, which can be used for another purpose. Because of its high heat transfer performance of PHE, temperature gap is not necessary to be wide that you expect.

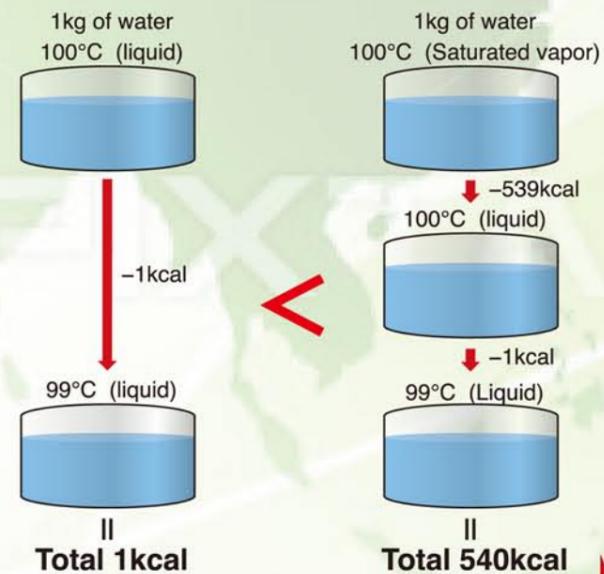


P4,7,10,11 GO!



Do not miss the latent heat

Definition of the thermal energy, 1 kcal is the heat to change 10C of the 1kg of the liquid water. On the other hand, when it comes to the vapor, 1kg of the water vapor (steam) releases about 539 kcal when it condenses. It is so-called latent heat, which is more than 500 times greater than the liquid. If you find the wasted vapor, you must try to recover the thermal energy from it.

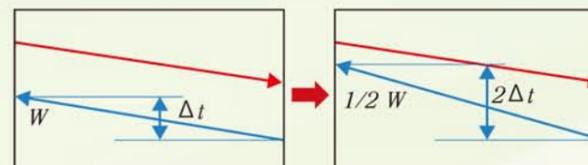


P5,8,13 GO!



Increase the temperature gap, and reduce the flow rate

According to the formula of the heat load,
 $Q = p \times Cp \times W \times (t2-t1)$
 $= p \times Cp \times (1/n)W \times n(t2-t1)$
 when temperature gap increase n times, flow rate is decrease 1/n. By applying this way, flow rate is possible to be reduced so that electricity of the circulation pump can be cut. In addition, piping diameter can be smaller. It results cutting the piping and construction cost as well.

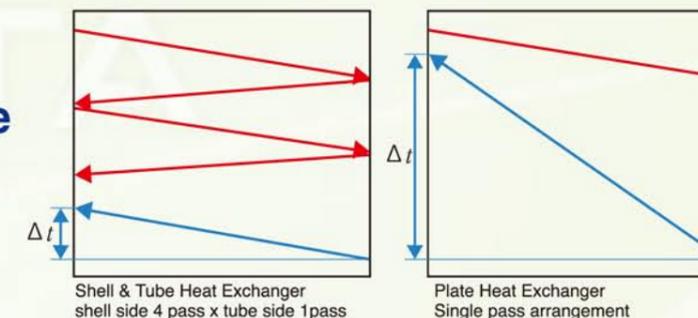


P6 GO!



Doubt your common sense

When using a conventional shell & tube heat exchanger for heat recovery, usually lower potential heat resources are ignored and commonly just discharged. However, when applying PHE for heat recovery, you can utilize even such lower potential energy resources. Perfect counter current flow and single pass design can make it possible.



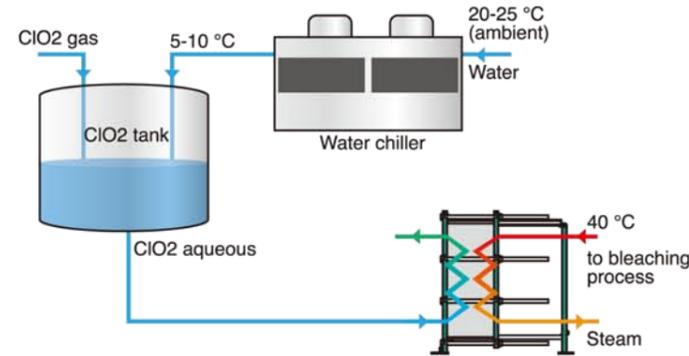
P5,6,8,9 GO!

Chemical industries

1-1 Bleaching application for KP

Process Overview

This is for the kraft pulp (KP) bleaching process, which use ClO₂ to bleach the pulp. ClO₂ is absorbed by the chilled water and heated it up to activate it.



Applicable Principle



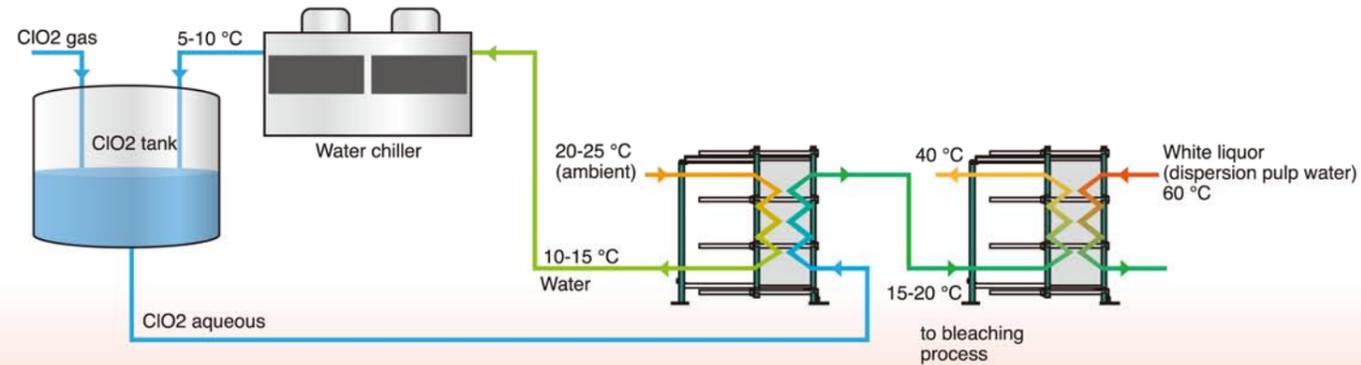
Create the infinity loop
Both the cooling and the heating processes are built in the same circuit, - the feed water is cooled down and heated up afterwards. Apply the infinity loop principle so that it is possible to exchange the heat between the feed water and ClO₂ aqueous.



Consider heating and/or cooling resource
Look for the other heat resources instead of the steam. The temperature to be achieved of the ClO₂ aqueous is only 40°C. Not necessary to use the steam to heat it up.

Result

Below is the flow diagram after the improvement. It results in enabling to reduce the electricity for the water chiller and steam is no longer consumed.



Powerful ITEMS



WX
Below is the flow diagram after the improvement. It results in enabling to reduce the electricity for the water chiller and steam is no longer consumed.

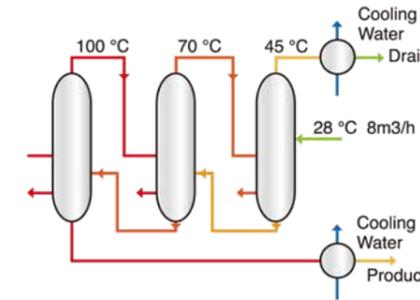


GX
Because the white liquor, which is possible to be a heating media instead of the steam, includes pulp fibers and other particles, conventional plate heat exchanger is difficult to be used. HISAKA GX series, which has wider channel gap, is able to solve this issue.

1-2 Multi effective column evaporator

Process Overview

This is the standard the triple effective evaporation column, which is traditional and well known process to reduce the steam consumption to appoloximately 1/3 from single column. Process is almost perfect, but something are still hidden.



Applicable Principle



Create the infinity loop
Product is simply cooled down by the cooling water. Is it possible to be cooled down by any streams?



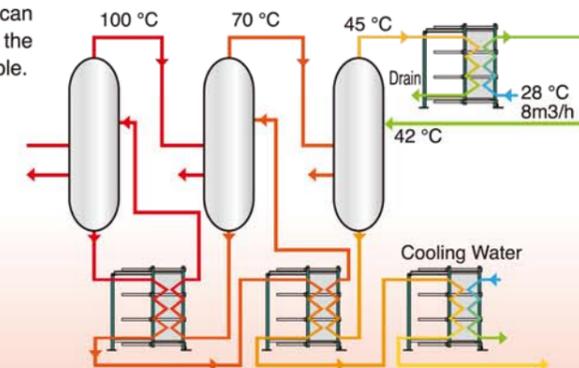
Do not miss the latent heat
Vapor is simply condensed and discharged. Is it able to recover?



Doubt your common senses
When uses PHE as the condenser instead of existing heat exchanger, how much heat can be recovered?

Result

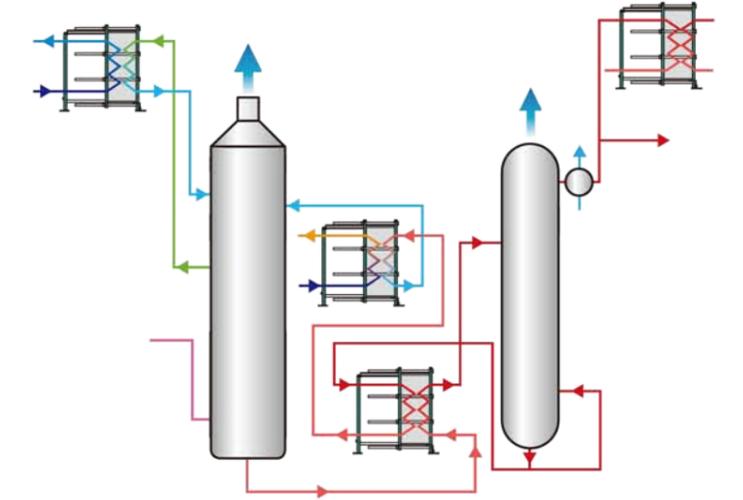
The wasted vapor temperature from the 3rd column is so low that it is usually ignored. But PHE is still applicable under much closer temperature gap because of its high efficiency. In this case, wasted vapor is used for pre-heating of the process feed. Additionally, new heat recovery network can be created by the infinity loop principle.



1-3 CO₂ absorption

Process Overview

CO₂ recovery system consists on an absorption tower and a stripper. In between two columns, a typical infinity loop can be observed. Lean amine, which absorbs CO₂ gas selectively, goes back to an adsorption tower after releasing CO₂ at the stripper.



Applicable Principle



Create the infinity loop
Rich amine is heated up in order to release CO₂ gas and lean amine is cooled down to capture CO₂ gas circulating between two towers. Rich and lean amine helps each other to cool down or to heat up.



Doubt your common senses
Thanks to PHE, the initial cost can be minimized and efficiency can be maximized.

Powerful ITEMS



SX-80
SX-80 is specially developed for this application particularly, in order to contribute the carbon emission, which is being disputed the solution globally so far.

N-EPDM

Coming together with SX-80, N-EPDM which is having a special composition can prolong the gasket life with better chemical and temperature resistance rather than normal EPDM.

2-1 Higher NTU plate

Process Overview

NTU, the number of the heat transfer unit, describe the process temperature condition as below.
 $NTU = (T1 - T2) / LMTD = (t2 - t1) / LMTD$
 when T1, T2 is the inlet and the outlet temperature of hot side, t2, t1 is of cold side.
 NTU=5, 13°C → 8°C and 7°C → 12°C is the conventional design in HVAC application. When increase the temperature drop double between inlet and outlet, NTU=10 allows reducing the flow rate half. Consequently it results in minimizing the energy consumption of the pump. Not only this, but also in cutting the construction cost such as piping and circulation pump capacity.

Applicable Principle



Increase the temperature drop

As following the formula of the heat balance, flow rate can be reduced by increasing the temperature drop.



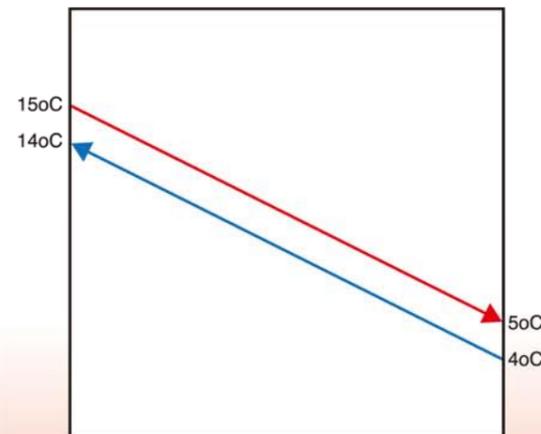
Doubt your common senses

HISAKA achieved the value 10 of NTU by the new corrugation design of new SX series. It is available to reduce the flow rate half comparing to the conventional design condition NTU=5 case.

Result

The table shows that the benefit brought by HISAKA, 35% of the piping size as the initial construction cost, 40% of the electricity as the running cost can be reduced. Eventually 40.9% of the carbon emission is achievable as the Green Building.

	Before	After	Benefit
Secondary side	12-7 deg	15-5 deg	
Primary side	11-6 deg	14-4 deg	
Flow rate	500m ³ /h	250m ³ /h	-50.0%
Heat Exchanged	2,907kW(800RT)		
Piping size*	350A(14")	200A(8")	-35.0%
Power consumption	200MWh	120MWh	-40.0%
CO ₂ emis sions*	110kg/h	65kg/h	-40.9%
Remarks	* fluid velocity: 2-3m/s **pump head: 9.8m		



Powerful ITEMS

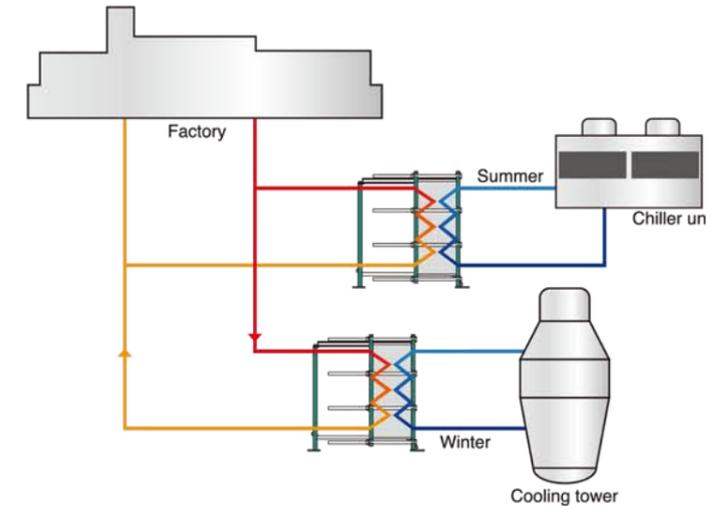
New SX series
New SX series posse the new evolitional design of the heat transfer area, vertical multi herringbone pattern, the "thunder bolt" allows all building to enjoy NTU=10 application.

AHRI400 certificate
In order to ensure the performance of the plate heat exchanger, HISAKA SX series have been applied AHRI400, liquid to liquid heat exchangers program. The performance were officially authorized and certified by the independent third party, AHRI (Air-conditioning, heating and Refrigeration Institute).

2-2 Free cooling system

Process Overview

In the region where has winter season, the ambient temperature can be utilized for cooling. In the winter season, temperature of the outside is cold enough to use. So-called free cooling system invented in Japan can optimize an electricity of the refrigeration system.



Applicable Principle

Consider heating and/or cooling resource

An idea seems to be a quite simple. However, to keep on looking for the alternative resources introduce such kind of the energy saving system. Shall we pay an attention on the facilities around?

Powerful ITEMS



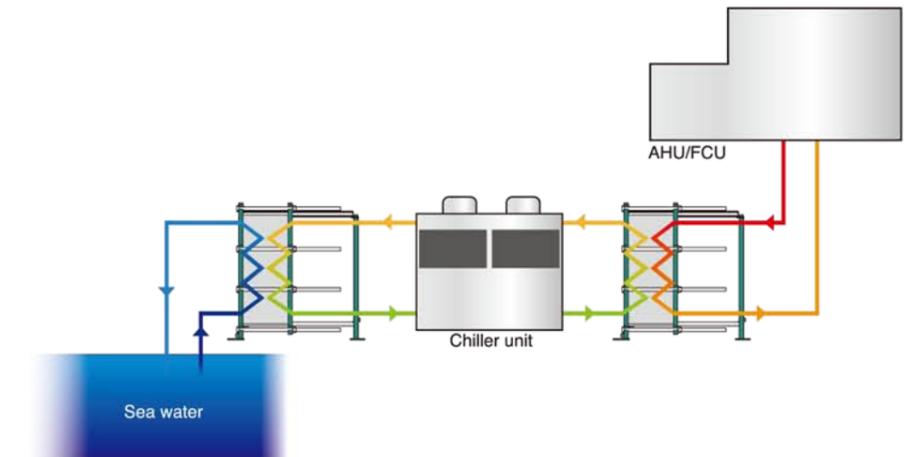
Large plate exchangers, JUMBO

HISAKA is the good in the market for the large heat exchanger. HISAKA JUMBO is capable to cater for the huge capacity of the cooling/chilled water demand.

2-3 Hidden potential resource

Process Overview

Resources many times often neglected are the natural resource that is surrounding us. Take chiller unit for instance, cooling tower is used for condenser. By using alternative resources such as the river water or sea water instead of the cooling tower, these are completely free of charge.



Applicable Principle

Consider heating and/or cooling resource

If sea water is directly led into the chiller unit, the condenser inside, which is not designated for the sea water, get damaged. How to utilize it?

Powerful ITEMS

Titanium plate heat exchanger

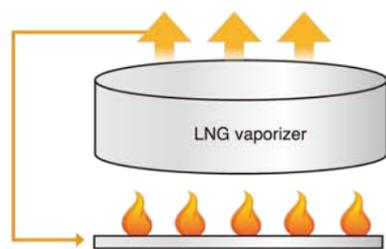
More than 50 years ago, HISAKA had successfully launched the titanium plate heat exchanger. Due to the better resistance of titanium against the chemicals, it has been spread rapidly. Sea water is also the range which is covered by titanium. HISAKA Titanium plate can completely stand for sea water.

Power & Energy

3-1 Natural gas evaporation system

Process Overview

While LNG is gasified to use as a fuel, LNG is heated up by burning itself. Focusing on the latent heat of LNG, this heat can generate chilled water. Of course no longer burner is required. This idea is applicable not only for LNG, but also for LN2, LHe, etc.



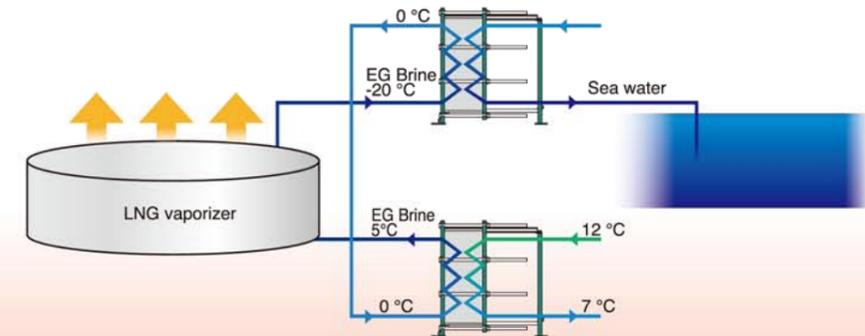
Applicable Principle



Do not miss the latent heat
The phase changes liquid to gas means the latent heat is able to utilize. In this case, the main point is how to utilize this potential energy.

Result

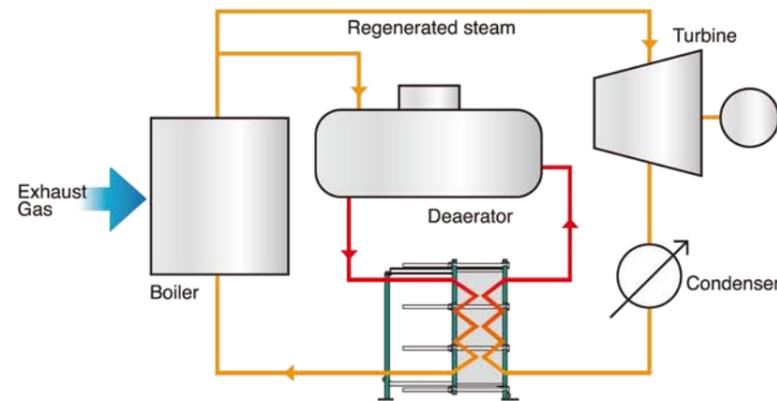
While LNG is gasified to use as a fuel, LNG is heated up by burning itself. Focusing on the latent heat of LNG, this heat can generate chilled water. Of course no longer burner is required. This idea is applicable not only for LNG, but also for LN2, LHe, etc.



3-2 Condensate recovery

Process Overview

In the power plant, the boiler feed water (deaerator suction) is needed to heat up. Usually, there is an energy saving system inside which is exchanging the heat with condensate (steam drain). Due to the high design pressure, shell & tube type heat exchanger is preferable. due to high design pressure.



Applicable Principle



Create the Infinity loop
Infinity loop has already existed inside by shell and tube type heat exchanger. Is there any possibility to adopt plate heat exchanger instead?



Doubt your common sense
Applicable range of plate heat exchanger is quite limited. This is the common sense in the market. But actually is it true?

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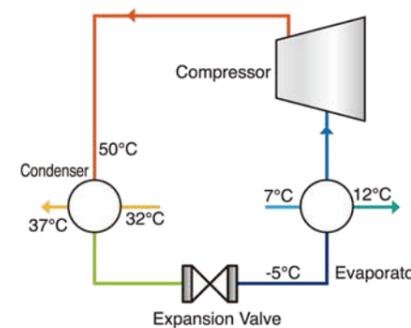


NX
HISAKA NX has broken through the limitation of the conventional plate heat exchanger. Wider applicable range, it can stand up to 250°C/9.5MPaG.

3-3 Refrigeration system (a)

Process Overview

Generally, the refrigeration system has two heat exchangers, one is the evaporator and one is the condenser. To increase the performance of the system, the one of the effective way is lowering the temperature of the condenser and/or increasing the temperature of the evaporator. It can reduce the work load for the refrigerant compressor so that efficiency can be improved.



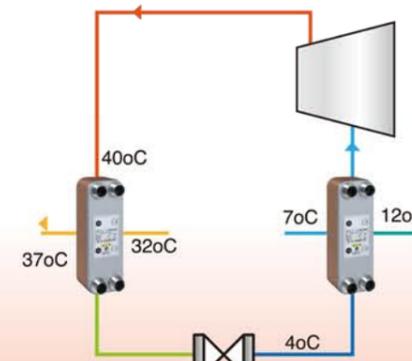
Applicable Principle



Doubt your common sense
Although replacing from coil or shell and tube heat exchanger to plate type, but benefit is not only the cost, the weight, holding volume and the space. When considering the working temperature and/or pressure of the refrigerant, plate heat exchanger is indispensable items for the refrigeration system.

Result

BHE (Brazed plate Heat Exchanger) is one of the best selections for the refrigeration system. It can optimize and improve the total system entirely.



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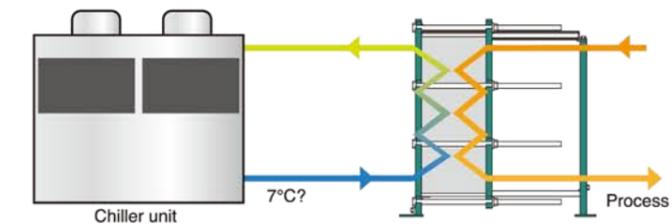


BRC series
Innovation, this is the appropriate words for BRC series. This is also the group of BHE's, but actually everything is different from before. The precisely designated plate arrangement provides the perfect distribution of the refrigerant, resulting in the massive high heat transfer co-efficient. BRC opens the door to the new history of the BHE.

3-4 Refrigeration system (b)

Process Overview

The process simply shows the normal usage of the chiller unit and plate heat exchanger. Even simple, there is an idea to be shared.



Applicable Principle



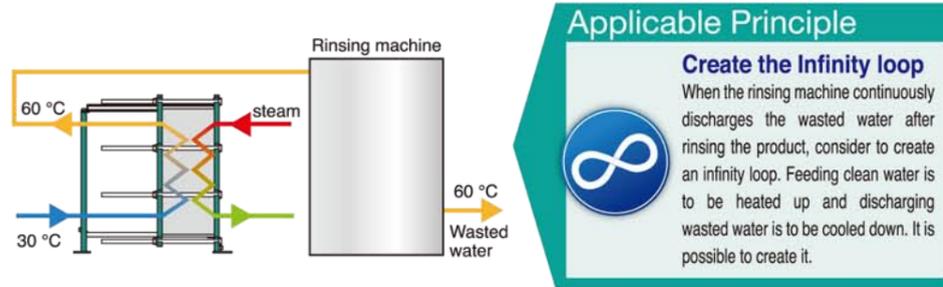
Doubt your common sense
Default setting of the standard chiller is 7°C in the market. However, is it necessary to be? When increase the temperature to 8°C even 1°C, it can approximately cut 3% of the electricity consumption. Optimize the chilled water setting to save energy by the plate heat exchanger.

General Industries

4-1 Rinsing Process

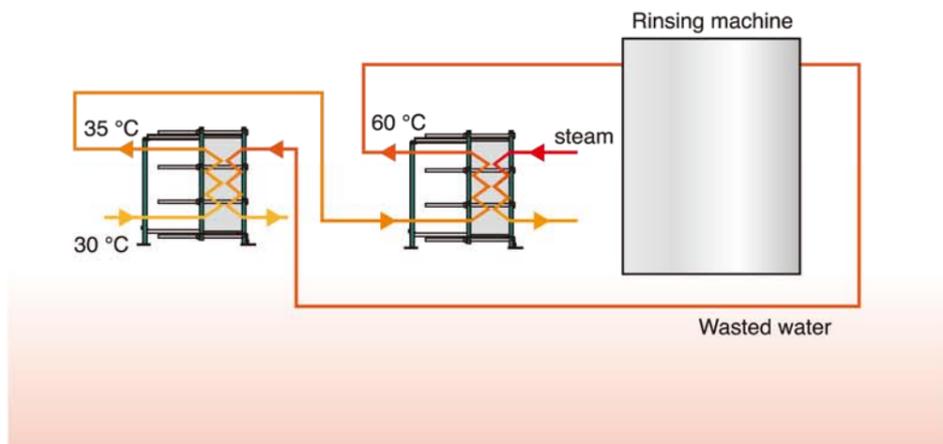
Process Overview

In order to clean/wash/rinse the product effectively, hot water is supplied heating up through the heat exchanger. These applications are often seen in the bottling process, plate glass process and so on.



Result

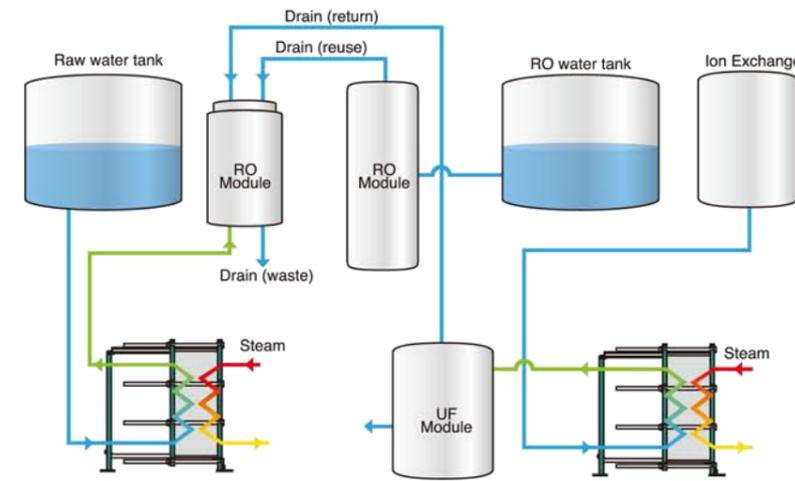
This is the typical example how to recover the heat by the infinity loop. Always focus on the feed and discharge if it is heated up and cooling down. An another similar application is surely found



4-2 Ultrapure water (UPW) system

Process Overview

Especially in the precision industry, such as a semi-conductor, a liquid crystal screen, solar panel factory is required such high plurality water in the process. Ultrapure water (UPW) is refined through RO films, which maximize its performance around 25°C. Usually plate heat exchanger is installed before the RO modules.



Applicable Principle

Create an infinity loop

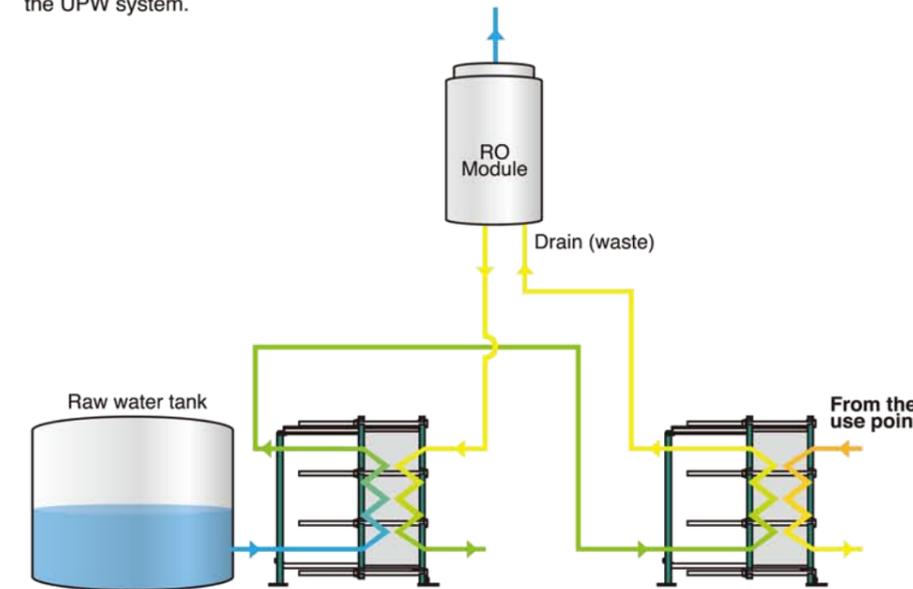
The 25°C of raw water is fed to the RO module, and RO module is discharging the drain which is also 25°C. Applying an infinity loop, raw water can be heated up by drain from the RO module.

Consider heating and/or cooling resource

If there is some another heat resource, such as UF drain or use point return, it can be used instead of steam to heat up.

Result

As shown picture, combining the infinity loop consisted on RO feed and discharge RO, and RO heater by use point return, the heat recovery system is established in the UPW system.



Powerful ITEMS

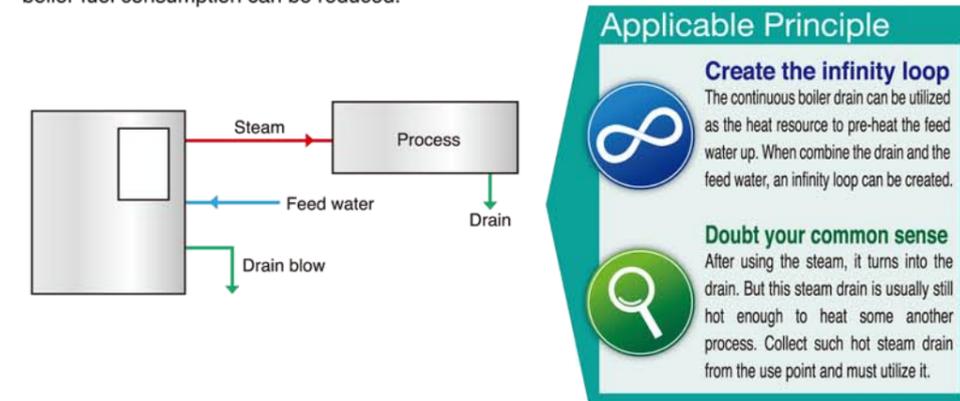
PTFE cushion gasket

Because of the plurality of the UPW, PTFE cushion gasket is preferably applied in order to avoid any contamination. In addition, titanium plate is seldom required as the same reason.

4-3 Boiler blow recovery

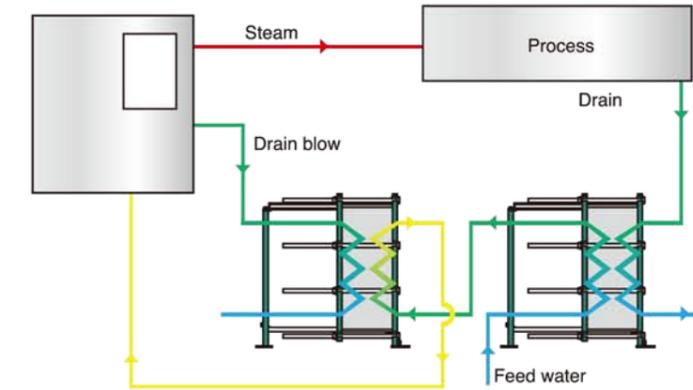
Process Overview

In common, boiler process has the continuous drain blow to maintain the water quality. Here, the pair of the feed and the discharge can be found. This is also quite simple application, but the point to be considered is how to heat up the boiler feed. If boiler feed water can be as high as possible, boiler fuel consumption can be reduced.



Result

Similar as UPW system, combining the infinity loop consisted on boiler feed and drain, and boiler feed heater by the returned drain, the heat recovery system is completed in the non-descriptive boiler system.

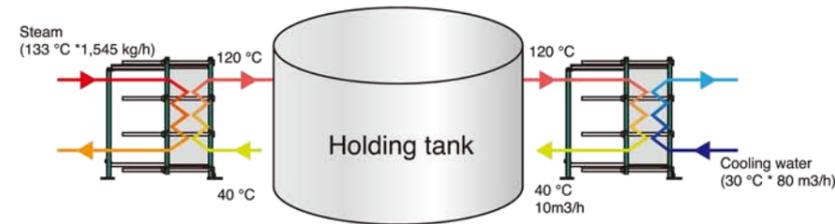


Food & Beverage

5-1 Sterilization system

Process Overview

This is the well-known process to sterilize the beverage. Heat it up to certain temperature and hold it to sterilize for a period (usually a few seconds to a minute). After that, it goes to be cooled down. Not only for the beverage, milk, milk product, soya sauce, liquid sugar, alcohol and any other liquor has also the same application.



Applicable Principle

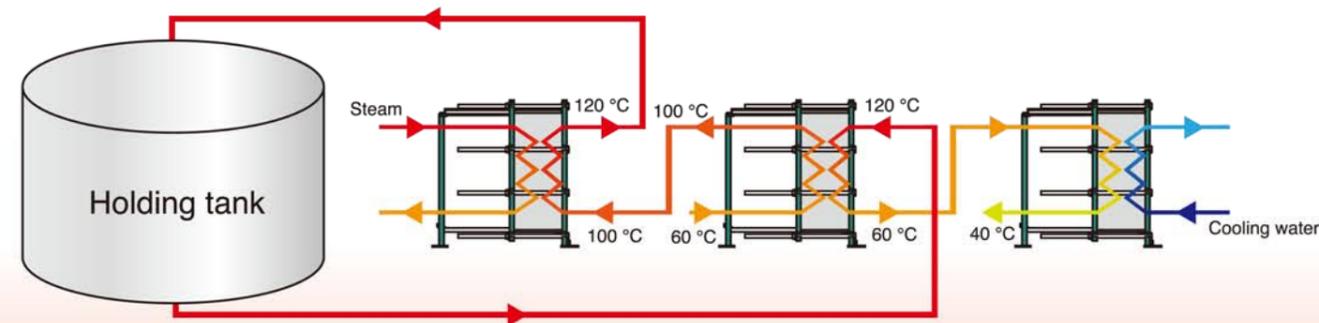


Create the Infinity loop

There is a pair of the raw beverage to be heat up and sterilized one to be cooled down. In such case, the infinity loop is definitely able to be created as an additional heat recovery section.

Result

Plate heat exchanger is able to combine multi units into one unit. In the food and beverage industries, it is commonly applied. Installing an additional heat recovery section, 1,352kg/h of steam and 70m³/h cooling water can be reduced consequently in this case.



Powerful ITEMS



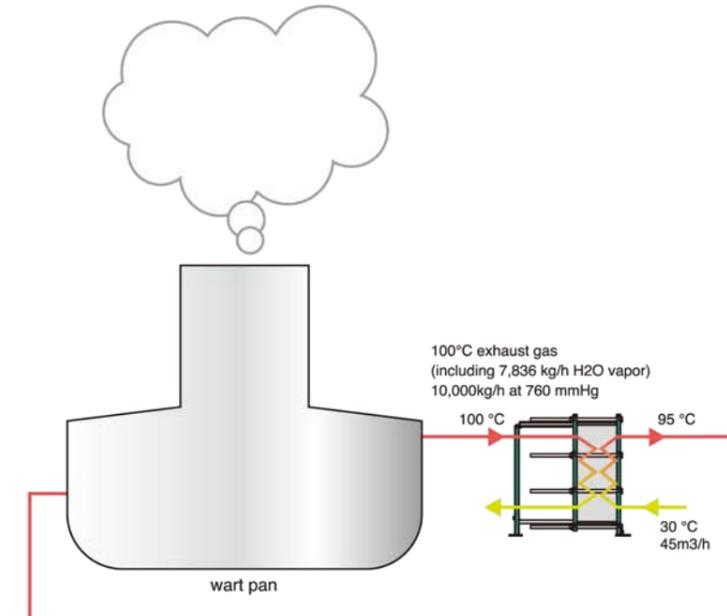
FX series

HISAKA FX was specially developed for beverage process, benefitting on anti-fouling, easy cleaning in place (CIP) and less holding volume. The plate shaped longer than normal type of plate heat exchanger to improve the maldistribution, which triggers the serious fouling and contamination.

5-2 Wort pan vapor recovery

Process Overview

When the crushed malt germinated wheat comes to the hot water, an enzyme is activated and the fermentation, which starch in the malt is decomposed into the sugar, starts. Adding the hop and boiling it up together, the wort is born. While boiling the wort, the wort pan vapor comes from the top of the wort pan.



Applicable Principle



Do not miss the latent heat

The wort pan vapor contains the water vapor partially. During the condensation, changing its phase from gas to liquid, huge amount of the heat is released. There is no doubt to be worth to recover its heat.

Result

Plate heat exchanger is able to combine multi units into one unit. In the food and beverage industries, it is commonly applied. Installing an additional heat recovery section, 1,352kg/h of steam and 70m³/h cooling water can be reduced consequently in this case.

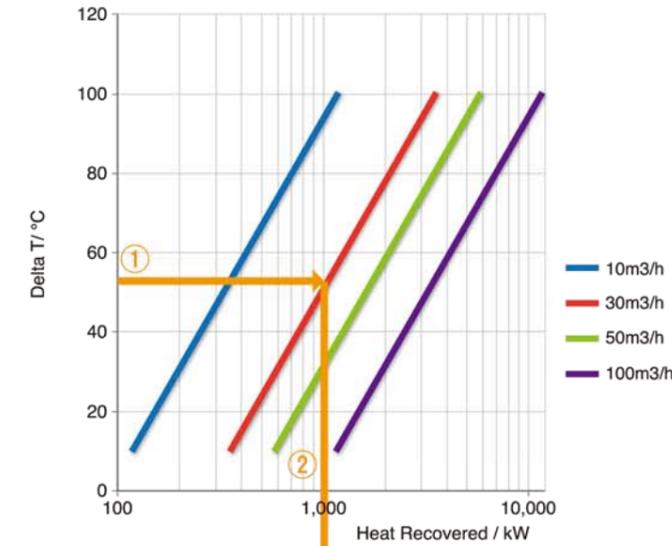
Powerful ITEMS



YX series

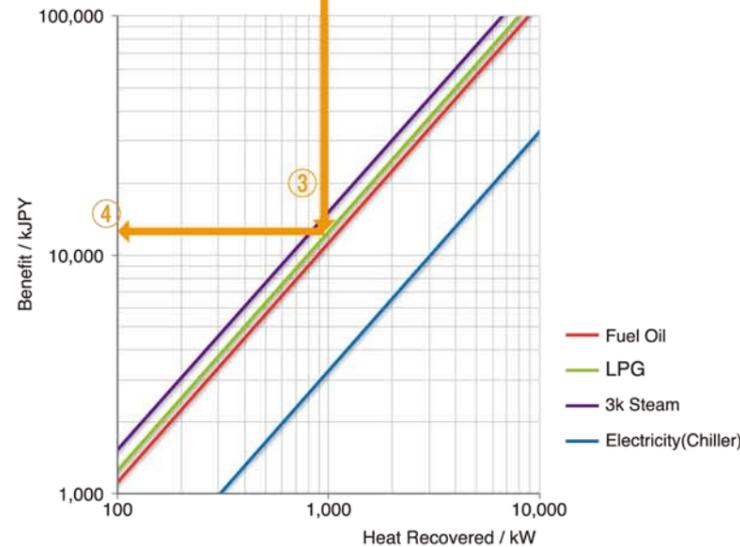
HISAKA YX is one of the unique models applicable for vapor condenser. Having a different diameter of the connection and the plate gap between vapor and cooling water side maximize the efficiency. YX has contributed to recover the huge latent heat from the vapor, since it had been launched until now.

How much is the cost of energy?



- How to know the amount of annual benefit?
- ① Recovering the heat as a hot water, 30m³/h and 50°C heated up.
 - ② Heat recovered is about 1,000kW
 - ③ Chose Fuel oil as the reduced energy recourse
 - ④ More than 10,000kJPY is the yearly benefit
 - ⑤ If an investment cost is around 10,000kJPY, this cost can be offset within only one year.

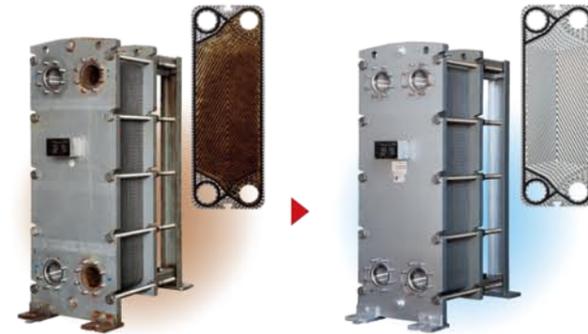
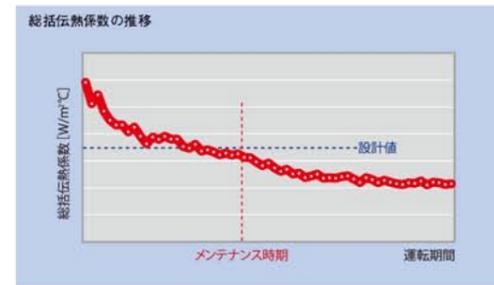
ASSUMPTIONS
 Operating hour 1,500hr/year (≒7h x 210days)
 Fuel Oil 70JPY/lit
 LPG 100JPY/m³
 Steam 6JPY/kg
 Chiller 11JPYkWh (COP=5)



Performance drop, but also losing money

NX only

Although improved the process successfully, the efficiency will drop after the long time operation. The fouling may cover whole plate surface, assuming the U value drops 20% of total. When total benefit by recovering heat is 10,000kJPY/y, 20% down means that we are losing 2,000kJPY/y. If the maintenance cost is less than 2,000JPY/y, it should be planned regularly and be carried out.



Web-Simulator

There are three ways to size the plate heat exchanger. The first is to visit to HISAKA WEB SIMULATOR on the web site, the second is to apply simple modeling method. To send the specification sheet after you filled in, as the last.

HISAKA Web-Simulator (HWS)

Simulation of Plate Heat Exchanger Now Possible on the Web

The world's first website for simulating Plate Heat Ex- changer is now launched on the Internet. By accessing the following URL and entering your design require- ments according to the instructions on the screen, you can get your own plate heat exchanger. In addition, you will be able to download the specification with outline drawing for installation work. The most appropriate sim- ulation of plate heat exchanger is possible 24-hours a day anytime, anywhere according to your convenience. http://www.hisaka.co.jp/simulator_english/

<http://www.hisaka.co.jp/phe/>

Top screen on the website

"Specification" Screen

Click here for a direct link.

An outline drawing with loading data and calculation result specification will be displayed. You can print or download the specifications.