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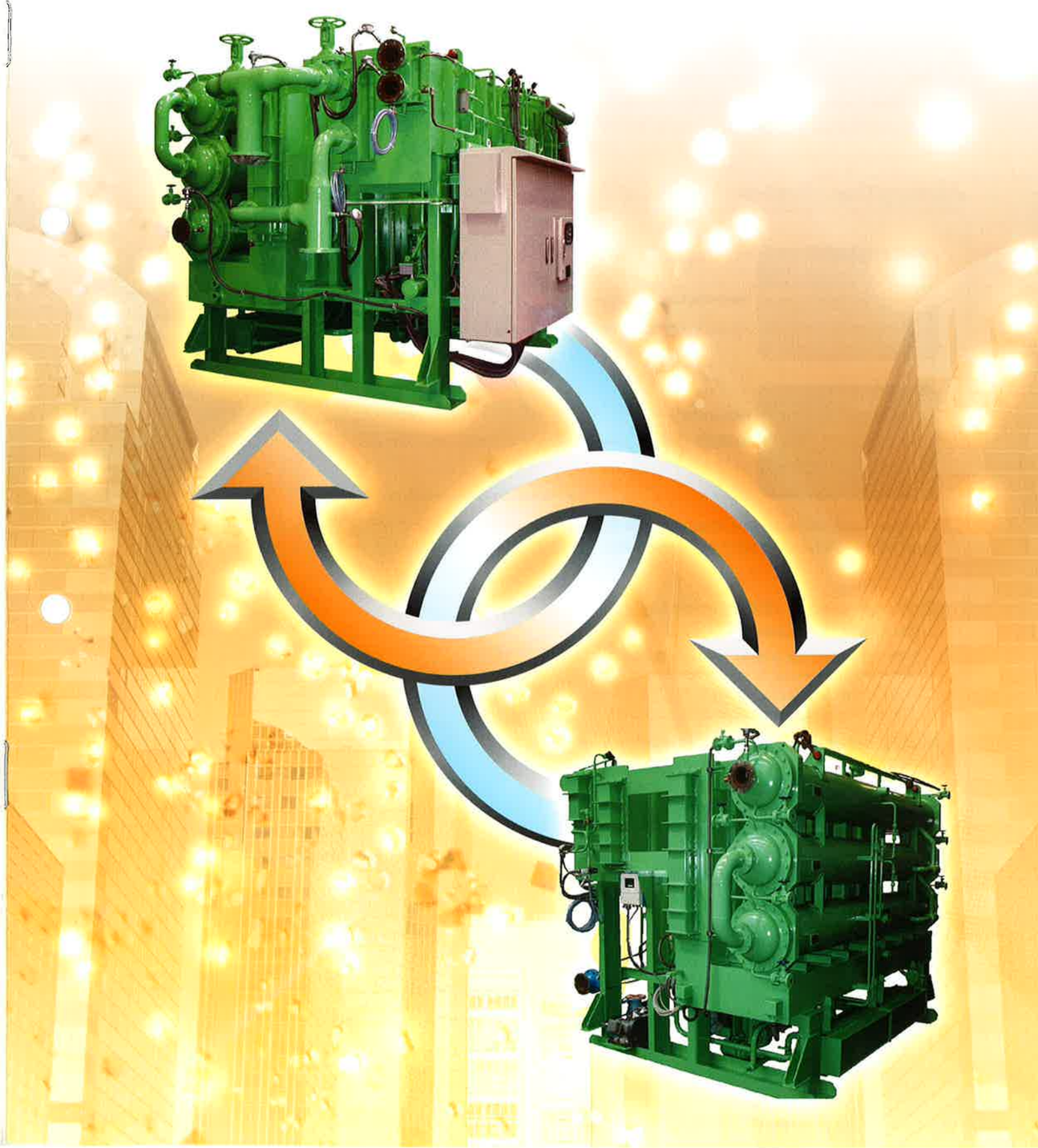
Hitachi Absorption Heat-pump



HITACHI

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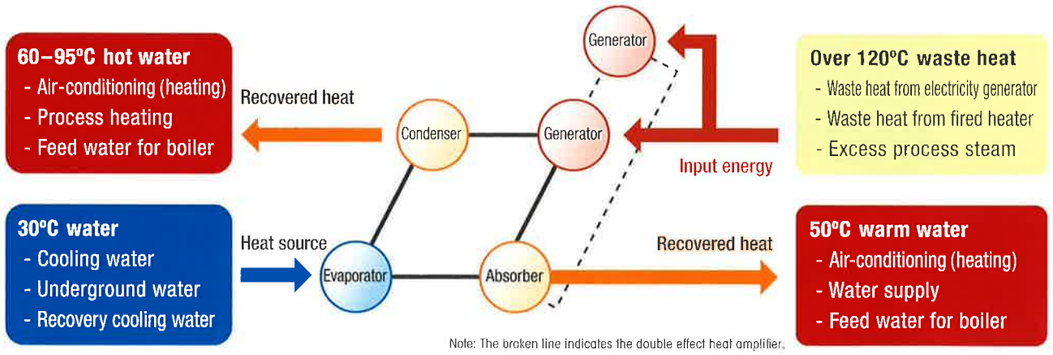
Hitachi Absorption Heat-pump

Utilizing low temperature waste heat, which is discharged without reclamation to generate useful high temperature heat for several applications.

Due to the rising demand of reducing Carbon Dioxide; the active global warming gas to prevent global warming, various technologies are advanced to reduce energy year by year for different kinds of equipment such as heat generators and boilers, etc.

However, independent equipments have its limitation, therefore to achieve CO_2 reduction goal, it is essential to utilize all waste heat energy from all production facilities in factories and plants as a system. To achieve this target, Hitachi enhances new features to its Absorption Heat-pump, enables the unit to deliver required high temperature hot water with the system that exploits well the waste heat (exhaust gas, drained water) generated from other production facilities. The system completes the favorable cycle and accomplishes the good reliability and high efficiency of factories and plants.

Absorption Heat-pump (Heat Amplifier Type)



Note: The broken line indicates the double effect heat amplifier.

The system uses several kinds of waste heat from different kinds of machines such as electricity generators, fired heater, excess steam from steam turbine to heat up low temperature water from 30–40°C to usable high temperature hot water of 60–95°C.

■ Energy saving by utilizing waste heat, heat reclaim efficiency COP = 2.3*1

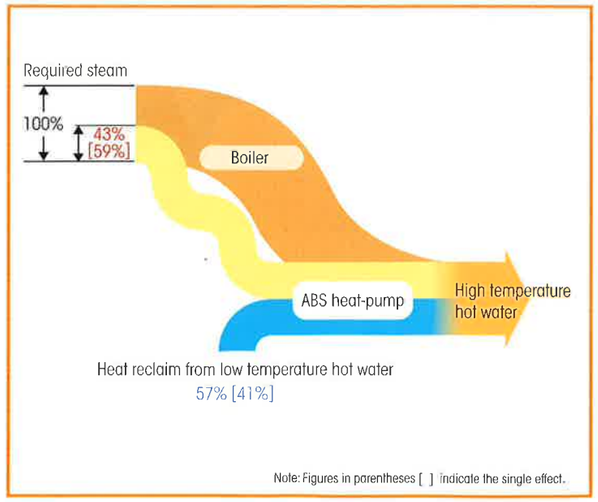
Heat pump cycle (Heat Amplifier Type) fully recovers heat from waste heat source to raise temperature of warm water to high temperature hot water. Resulting in high COP, and huge energy saving when comparing to boiler.

■ 95°C hot water supply is obtainable*2

As the pressure in generator does not exceed atmosphere pressure, then there is limitation in providing hot water. The heat-pump utilizes appropriate waste heat amount to heat up low temperature hot water to high temperature of 95°C hot water*2, contributing to less energy used.

■ Low pressure steam to high temperature hot water*3

Thanks to multistage absorption heat-pump cycle, makes it even possible to heat up low pressure steam (0.2–0.3 MpaG) to high temperature hot water, providing effectively used of energy.



Note: Figures in parentheses [ ] indicate the single effect.

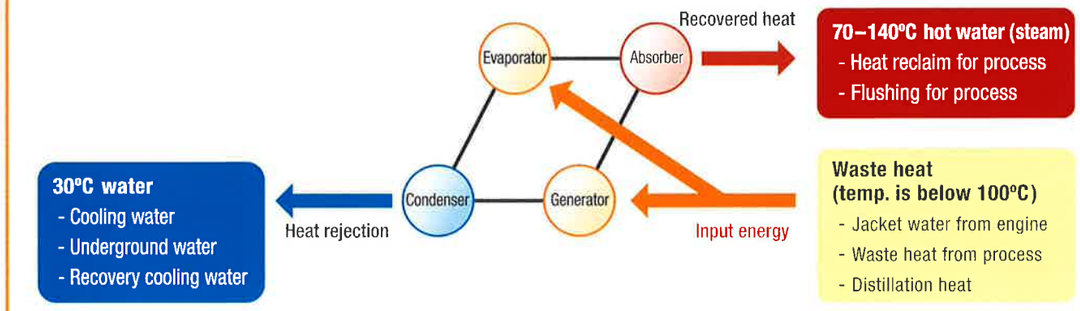
Note: *1: Double effect heat amplifier COP is indicated, Single effect heat-pump's COP is 1.7 and depends on hot water condition.
*2: In case of single effect. If double effect is used, the temperature of water supplied is 55°C.
*3: In case of single effect.

Hitachi Absorption Heat-pump

Absorption Heat-pump is a system to transfer heat from waste heat source to increase temperature of supplied hot water, helping in energy saving. In general process where low temperature source is used to produce chilled water, the system is called chiller system. On the other hand, in process that heat is used to generate higher temperature hot water, it is called heat-pump system. Among these heat-pump systems, when compare heat reclaimed by using absorption heat-pump and by using boiler, the additional heat (energy) required by absorption system is far less. Moreover, the absorption system can provide much high temperature hot water when compare with compressor type heat-pump system.

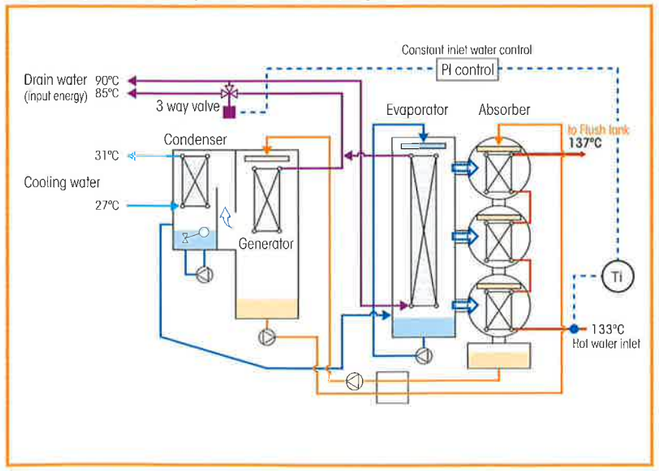
Heat Transformer Type Heat-pump

Absorption Heat-pump (Heat Transformer Type)

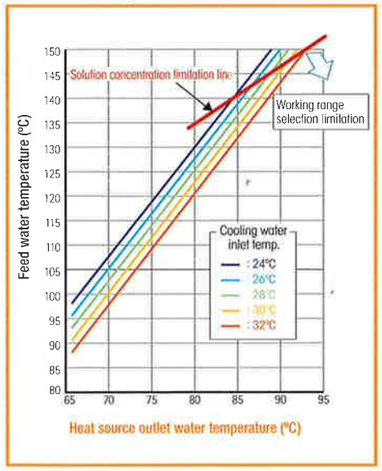


Using low temperature waste heat as energy source, the system can produce usable higher temperature hot water. These high temperature hot water can be used for adding heat to process or flushing process.

■ Principle of absorption heat-pump cycle



■ Selection graph based on condition



Actual Site Structure of Absorption Heat-pump System

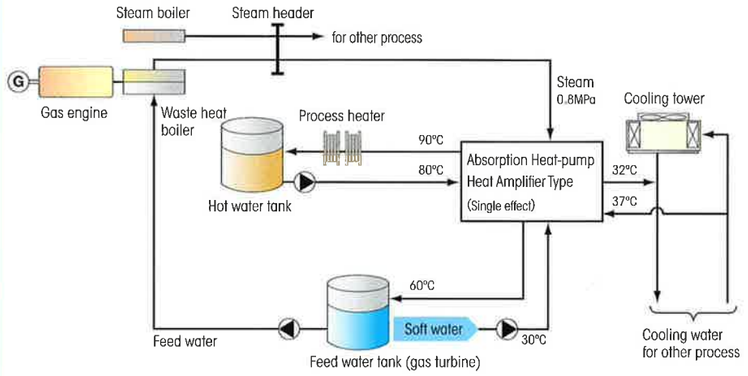
■ Production process heating and preheat feed water for boiler

Absorption Heat-pump Heat Amplifier Type (Single effect)

Heat up cooling water of 35°C to provide hot water for 2 different processes of
1) 90°C temperature hot water for production process and
2) 60°C temperature hot water for boiler feeding

Machine type

Absorption Heat-pump
Heat Amplifier Type
(Single effect)
Capacity: 1,300 kW
COP: 1.7



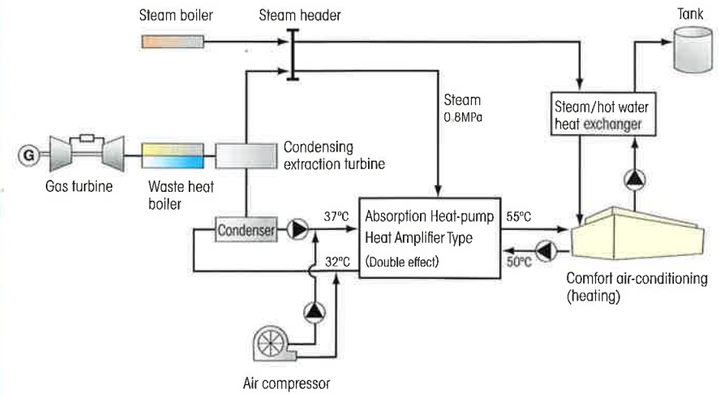
■ Comfort Air-conditioning (heating)

Absorption Heat-pump Heat Amplifier Type (Double effect)

Heat up 40°C warm water from electricity generator, HRSG and air compressor
to 55°C hot water for comfort air-conditioning (heating)

Machine type

Absorption Heat-pump
Heat Amplifier Type
(Double effect)
Capacity: 3,400 kW
COP: 2.3



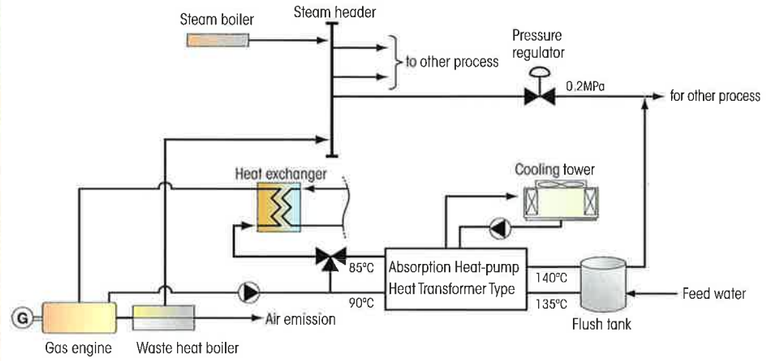
■ Flushing process–Humidification application

Absorption Heat-pump Heat Transformer Type

Recovery heat of 90°C hot water from Co-Generation system to generate and
provide 140°C high temperature hot water (or 0.2 MPa steam) for production process

Machine type

Absorption Heat-pump
Heat Transformer Type
Capacity: 300 kW
COP: 0.45



■ Main Supplied Record

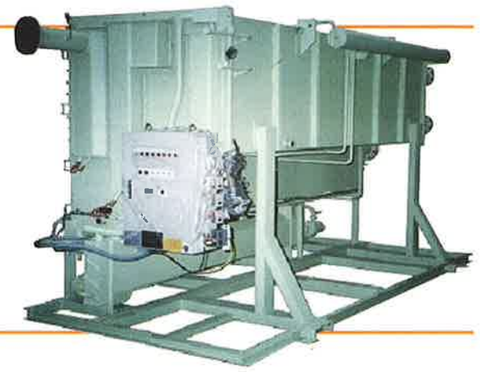
Type	Industry	Heat source	Supplied water for	Capacity (kW)	Delivery
Absorption Heat-pump Heat Amplifier Type (Single effect)	Spa Resort Hawaiians	Underground water	44–48°C heating comfort	3,256	1983
	Parts for automobile	Cooling water (Air Comp.)	40–50°C heating comfort	3,256	1993
	Food industry	Cooling water (Process)	26–62°C feed water for boiler	1,836	2002
	Food industry	Cooling water (Engine)	25–50°C hot water for process	897	2003
	Construction equipment	Cooling water (Compressor)	50–55°C heating comfort	3,349	2004
	Machinery	Cooling water (Engine)	50–55°C hot water for process	661	2006
Absorption Heat-pump Heat Amplifier Type (Double effect)	Chemical industry	Cooling water (HRSG)	50–93°C feed water for boiler	3,190	1981
	Textile industry	Cooling water (Process)	54–75°C hot water for process	2,343	1981
	Textile industry	Drained water (Process)	33–90°C feed water for boiler	1,049	1982
	Chemical industry	Cooling water (Process)	20–65°C hot water for process	1,723	1982
	Steel industry	Drained water (Flushing)	20–93°C feed water for boiler	2,430	1983
	Parts for automobile	Cooling water (Compressor)	57–65°C heating comfort	3,537	1985
	Automobile industry	Waste water (Desulphurization)	46–90°C feed water for boiler	8,750	1989
	Chemical industry	Cooling water (Process)	20–50°C for boiler/60–68°C for process	1,274	2005
Absorption Heat-pump Heat Transformer Type	Machinery	Cooling water (Engine)	133–137°C 0.2 MPa steam	150	2006

Hitachi Absorption Chillers (waste heat as heat source)

Hitachi absorption chillers exploits waste heat as heat source for various energy saving systems

Low Temperature Hot Water Absorption Chiller (Single effect)

- Use free heat from solar heat or waste hot water from incinerator therefore there is no additional cost from heat source, extremely energy saving unit.
- Temperature of hot water: 90–80°C



High Temperature Hot Water Absorption Chiller

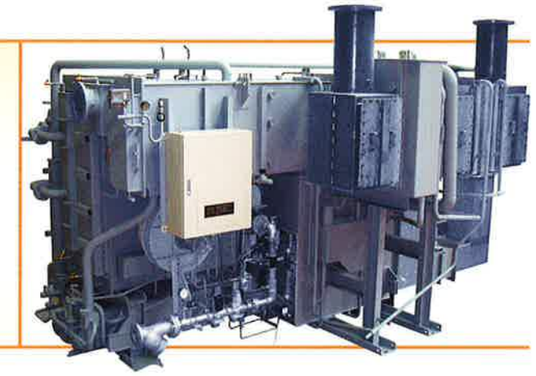
- Use hot water from gas engine (electricity generation)
- Temperature of hot water must be higher than 140°C

Absorption Heat-pump

- **Absorption Heat-pump (Heat Amplifier Type)**
  Utilize waste hot water, excess steam or high temperature hot water to heat up low temperature water from 30–40°C to high temperature hot water of 60–95°C. The heated up water can be used for production process.
- **Absorption Heat-pump (Heat Transformer Type)**
  Use low temperature waste heat to elevate the temperature which is higher than heat source. The heated water is used for process or flushing.

Direct Exhaust Gas and Hot Water Type

- Utilizing both exhaust gas and jacket water from gas engine, saving a lot of energy.
- Multi energy heat source type: exhaust gas from diesel engine can also be used as a heat source for chiller.



Non-freezing Fluid Absorption Chiller (Brine chiller)

- World first brine chiller with lithium bromide refrigerant which can produce -5°C of non-freezing fluid
- Using water and lithium bromide solution which is not harmful to environment
- Chiller operates at under atmosphere pressure
- Waste heat can be used as heat source
- Reduce greatly the electricity cost