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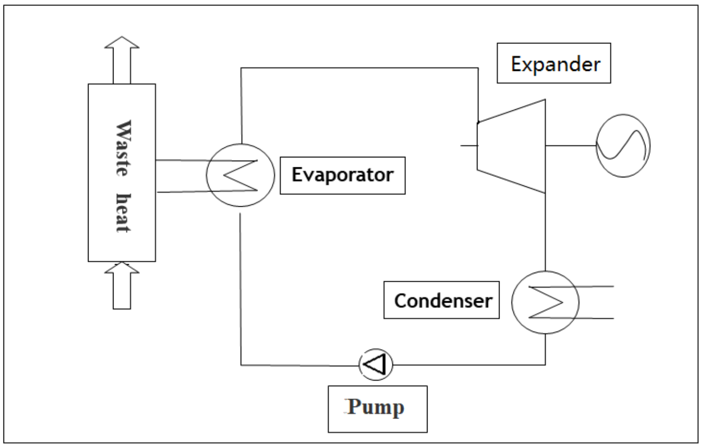
Power Generation Technology using Low-Temperature Organic Rankine Cycle

In many industrial processes, up to 50% of the input energy is emitted as waste heat. By applying low-temperature Organic Rankine Cycle (ORC) power generation technology, this waste heat can be converted into valuable electricity, reducing net energy consumption and at the same time minimizing carbon dioxide emissions to the environment. ORC is in principle the same as conventional Rankine cycle except that low boiling point organic compounds are used as the working media. An ORC system typically consists of four components: evaporator, expander, condenser and circulation pump.



The liquid working medium absorbs heat in the evaporator and transforms itself into gaseous state. The expansion in the expander drives a generator to generate electricity. The gaseous working medium at a reduced pressure after the expander is condensed back into a liquid state in the condenser, and is then pressurized using a circulation pump,

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and returned to the evaporator to absorb the heat for the subsequent cycle. This completes an organic Rankine cycle.

Compared with traditional power generation technology, low temperature ORC power generation technology has the following advantages:

① The technology is highly modular with automatic control and compact structures, resulting in low costs for both installation and maintenance.

② The heat source used is clean energy, mainly from industrial process waste heat, solar energy, ocean temperature difference, geothermal heat, etc.

③ The organic working fluid maintains dry state from high pressure to low pressure during the expansion process, thus reducing the impact on the equipment.

④ The organic working fluid has favorable thermodynamic properties, with low boiling point and high vapor pressure, resulting in high utilization rate of the low temperature heat source.

Conventionally, shell-and-tube type of heat exchangers are used as the evaporator. However, the heat transfer efficiency is normally very low and the equipment is bulky, which is incompatible with the compact and modular design requirement of ORC systems. In contrast, plate-and-shell heat exchangers, as a new type of high-efficiency heat exchanger, possess the advantages of shell-and-tube heat exchangers and plate heat exchangers, and are therefore more suitable for modular design of ORC systems.

Plate-and-shell heat exchangers from IES use special "herringbone" corrugated plate to create turbulence when the medium flows through the heat exchanger, resulting in higher heat transfer efficiency. At the

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same time, IES uses advanced laser welding technology to weld the heat transfer plates. Therefore, IES plate and shell heat exchanger can withstand higher operating pressures due to their small heat affected zone and good welding quality.

In order to ensure product quality, each plate-and-shell heat exchanger offered by IES undergoes a vigorous helium leak detection process. The small molecular weight and high permeability of helium gas make the instrument extremely sensitive and less prone to interference. Therefore the leak detection rate is very high.