High Temperature Steam Heat Pump Technology

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Heat pump technology including the cycle design/analysis, heat exchanger design/manufacturing, and compressor performance assessment technology for heat pump system generating high temperature steam over 120℃

Client / Market

- Existing boiler, heating market and industrial sectors that require high temperature steam, such as drying and food process

Necessity of this Technology

- Generating steam using heat pump instead of conventional boiler to save energy and reduce greenhouse gas emission
- Technology that actively utilize renewable and waste heat of surroundings
- A technology recently commercialized in advanced countries; necessary to develop a very high level technology of world best through active investment and intensive R&D
- Heat energy network technology using high temperature thermal storage–steam heat pump system that resolves the heat energy supply and demand mismatching problem

Technical Differentiation

- Existing heat pump system could be operated to discharge water temperature of 80 to 90℃, but this technology includes design and related technology for generating steam of 120℃ or higher

Excellence of Technology

- Design and manufacturing of heat exchanger using new refrigerant (R245fa)
  - Development of correlation between sensible and latent heat; design procedure establishment of actual scale heat exchanger
- Development of oil–less refrigerant compressor performance test apparatus for high temperature steam heat pump
  - Apparatus for testing performance of oil–less refrigerant compressor such as isentropic efficiency measurement, that using a gas cycle modifying the evaporation and condensation section for reducing the size of equipment

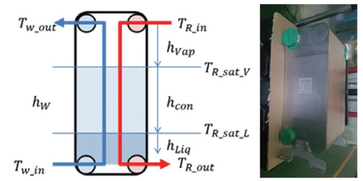
DESIRED PARTNERSHIP

Technology Transfer | Licensing | Joint Research | Other

TECHNOLOGY READINESS LEVEL [TRL]

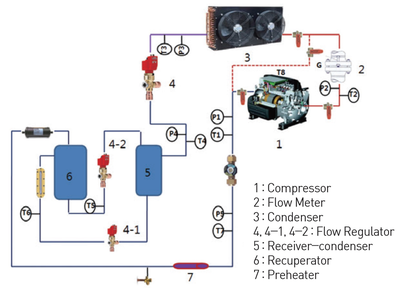
Research, basic explanation | Project concept or idea development | Technology idea verification | Prototype development | Trial product production/ evaluation in similar environment | Pilot field demonstration | Development and optimization of commercial model | Commercial product demonstration | Mass production and initial market launch

R245fa–applied Heat Exchanger Design, Manufacturing



– R245fa heat transfer coefficient (for gas) : $Nu_{sup} = 0.09093 \cdot Re^{0.69496} \cdot Pr1/3$
– R245fa condensation heat transfer coefficient : $Nu_{con} = 3.38887 \cdot Re^{0.51161} \cdot Pr1/3$
– R245fa heat transfer coefficient (for liquid) : $Nu_{liq} = 0.36492 \cdot Re^{0.59774} \cdot Pr1/3$
– Water heat transfer coefficient : $Nu_w = 0.33446 \cdot Re^{0.64778} \cdot Pr1/3$
– Water fanning factor : $f = -2.04361 \cdot Re^{0.02903} + 3.19576$

Compressor Performance Test Apparatus



Current Intellectual Property Right Status

KNOW–HOW

- Steam generation heat pump cycle design technology
- Compressor performance and reliability evaluation technology and testing method
- Technology of correlation equation development for design of heat exchanger