



Mitsubishi Heavy Industries Thermal Systems, Ltd.

Chubu Electric Power Co., Inc.

MHI Thermal Systems and Chubu Electric Power Jointly Develop “Q-ton Circulation” Heat Pump, Launching Set for August

– Adoption of R454C low-GWP refrigerant, a first in Japan, contributes significantly to curbing global warming –

Tokyo, February 27, 2018 – Mitsubishi Heavy Industries Thermal Systems, Ltd. and Chubu Electric Power Co., Inc. have jointly developed the “Q-ton Circulation,” an air-source circulation heat pump*¹ engineered for use in factories. The Q-ton Circulation reduces environmental impact significantly through adoption, for the first time in Japan, of the R454C, a refrigerant that features a global warming potential (GWP)*² approximately one-tenth previously available refrigerants. It is also the industry’s first heat pump of its type capable of heating water to 75°C (167°F) amid an outside temperature as low as -20°C (-4°F). The Q-ton Circulation will be marketed by MHI Thermal Systems, for sale in Japan from August 2018.

Today, steam boilers fired by fossil fuels are widely used to create the hot water required in factories for removal of greases, cleaning of parts, etc. Recently, heat pumps have become increasingly prevalent owing to their contribution to energy saving enabled by their outstanding efficiency. The heat pumps available to date, however, use refrigerants with GWP values in a range of 1,430 to 2,090 times higher than carbon dioxide (CO₂), and along with enforcement of the newly enacted Law Concerning the Discharge and Control of Fluorocarbons*³, calls had been raised for the development of refrigerants with lower GWP values.

In the newly developed Q-ton Circulation, lower environmental impact was targeted through adoption of the low-GWP R454C. Simultaneously, in pursuit of high energy efficiency a two-stage compression refrigeration cycle was adopted and optimal engineering of the refrigeration cycle was carried out through optimization of pipe diameters, etc. The cumulative result is outstandingly efficient operation—a COP*⁴ of 3.3—and the capacity to produce hot water up to 75°C amid an outside temperature as low as -20°C. Also, to provide swift after-sale service, remote monitoring of the Q-ton Circulation’s operating status is possible through use of IoT technology.

Main Features

1. Significant reduction in environmental impact through first adoption in Japan of low-GWP refrigerant

The Q-ton Circulation reduces environmental impact substantially through adoption, for the first time in Japan, of the R454C (GWP 146)—a refrigerant that meets GWP clearance requirements (150) already in force in Europe.

2. World's first heat pump with capacity to produce hot water up to 75° C amid an outside temperature down to -20°C

Adoption of a two-stage compression refrigeration cycle prevents reduction in the hot water temperature normally caused by a low outside temperature. Water heated to 75°C can be supplied throughout an outdoor temperature range of -20°C to 43°C (109°F)), to respond to year-round hot water needs in a factory.

3. Significant energy savings

Optimal engineering of the refrigeration cycle has enabled the achievement of outstanding energy efficiency (COP 3.3) as a circulation type heat pump. When adopted in place of a factory boiler, for example, annual running costs can be cut by approximately 67%.^{*5}

4. Swift provision of after-sale service through use of IoT technology

Round-the-clock remote monitoring of the Q-ton Circulation's operating status will be available through "M-ACCESS," MHI Thermal Systems' proprietary Internet access platform. This will enable speedy servicing in the event of a system malfunction.

Notes

**1: Air-source circulation heat pump: a heat pump that produces hot water by absorbing heat from the atmosphere.*

**2: Global warming potential (GWP): a measurement of global warming impact from greenhouse gases, as compared with impact from carbon dioxide.*

**3: The Law Concerning the Discharge and Control of Fluorocarbons took effect on April 1, 2015 as a revision of the earlier Law Concerning the Recovery and Destruction of Fluorocarbons. The new legislation mandates proper action to ensure against fluorocarbon leakage throughout all processes, and also calls for conversion to substitute fluorocarbons having a low GWP.*

**4: Coefficient of performance (COP): an index indicating the energy consumption efficiency of a heat source system. The higher the COP reading, the higher is the level of energy-saving performance. COP is calculated as heating capacity (kW) ÷ power consumption (kW), where power consumption refers to the power consumed by the heat source unit. COP readings do not include power consumed by externally installed circulation pumps. The Q-ton Circulation's COP of 3.3 is the value under the following conditions: external temperature 25°C (77°F) (relative humidity: 70%), water inlet temperature 60°C (140°F), and outlet temperature 65°C (149°F).*

**5: Refers to reduction when the Q-ton Circulation is installed outside for a process previously employing a gas boiler system with an overall efficiency of 50%. Reduction varies according to actual operation conditions.*

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