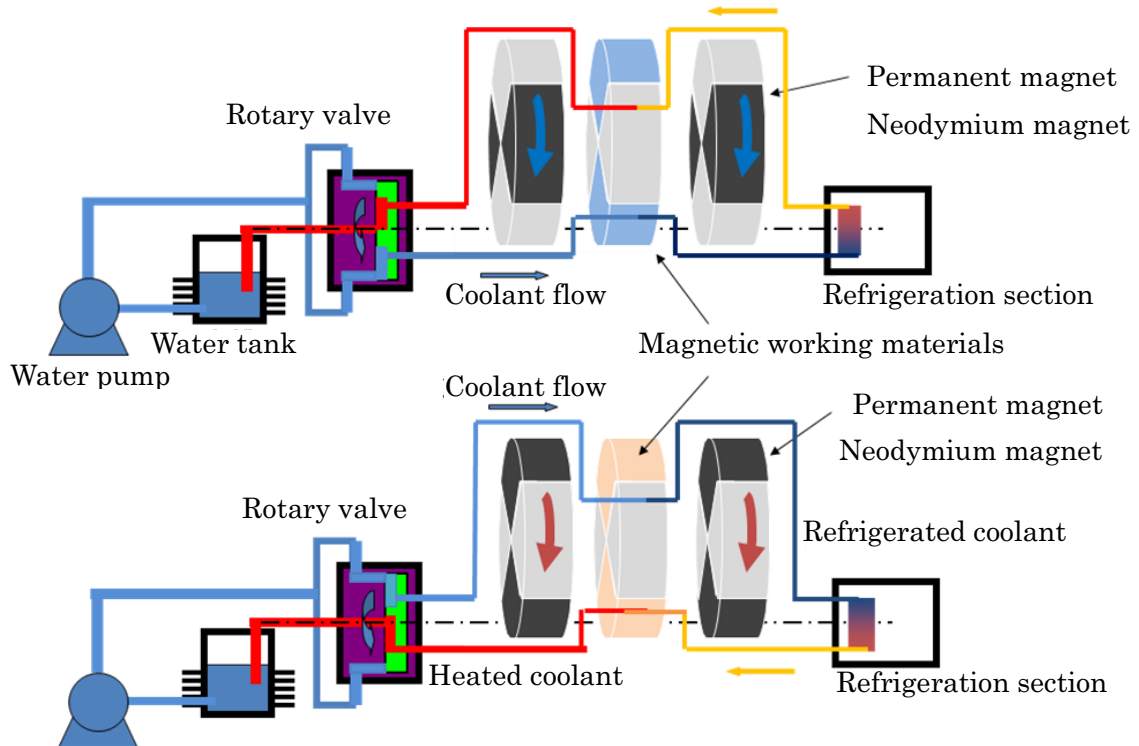


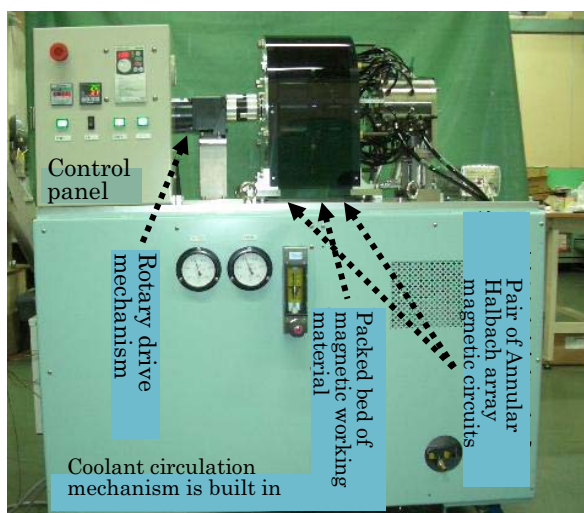
## 1. Components of a magnetic heat pump



In this heating and cooling system, changes are induced in the temperature of a magnetic working material sandwiched between a set of rotating permanent magnets (the temperature declines as the magnets are moved away, and increases when the material is sandwiched between the magnets). Heat is exchanged by means of a circulating coolant (water). The cooled coolant is used for cooling, and the heated coolant is used for heating.

Because the magnets rotate, the magnetic working material is repeatedly heated and cooled. Well-timed switching of the direction of coolant flow in coordination with the rotation of the magnets enables cooled coolant to be supplied to areas to be cooled (heated coolant in the case of areas to be heated).

## 2. System developed by Railway Institute for evaluation of performance of magnetic working materials



Source of magnetic field	Neodymium permanent magnet	Same as at left
Strength of magnetic field (T)	1.1	Same as at left
Magnetic working material	LaFe	Gadolinium
Mass of magnetic working material (g)	750	Same as at left
Refrigerating capacity (W)	104	63
Coefficient of performance (COP)	4.5	1.4
Dimensions of main unit (mm)	H400 x W450 x D350	Same as at left

### 3 Outlook for realization of COP of 10 or higher

Based on the evaluation results, which demonstrated that the performance of the system will improve with improvements in the performance of the magnetic working material, it is expected that the use of technologies to boost system capacity (increasing the strength of the magnetic field, reducing pressure loss, improving heat exchange performance, etc.) will realize a COP exceeding the figure of 3 obtained when using Gd, the conventional material, and that the application of high-performance magnetic working materials, the existence of which will be determined by universities and other centers of research, will realize a COP of 6 or higher. In addition, if we project the development of 10 kW-class systems at the level of practical use, the realization of systems with COPs higher than 10 as a result of the increased motor and pump efficiency achieved by increasing system size is technologically feasible.

