Performance of the Heated-water Unit

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The SPring-8 storage ring vacuum chambers are mainly extrusions made from aluminum alloy. The vacuum chambers have been baked by means of super heated water pumped through the water channels of the chambers as has been adopted at LEP [1]. Super heated water is generated by a mobile-type heated-water unit (HWU) [2]. This report describes the outline and performance of a HWU.

The proposed method for bakeout has the following advantages compared with an electrical heating method; 1) Bakeout and activation of non-evaporable getter (NEG) pumps can be simultaneously performed. The power radiated for bakeout from chamber surface is 4.9 kw/half- cell, while the power generated during NEG activation at the inside of chambers is 5.0 kw/half-cell. Therefore, the temperature of chamber can not be kept at 150℃ during NEG activation by the electrical heating method without cooling system. In our method, the HWU is equipped with a cooling system (heat exchanger) in order to remove the heat produced when NEG activation is carried out at the last stage of the bakeout period, the chamber being still at 150 ℃. 2) The chamber temperature during bakeout can be controlled easily and uniformly without a risk of overheating.

Figure 1 shows a layout of a HWU. The power generated by one HWU is 15 kW. The bakeout of a standard cell requires two HWU's. Since the vapor pressure of water at 150 ℃ is about 4 kgf/cm^{2}G, the minimum hydraulic pressure of heated water in the system circuits of HWU is set at 4.5 kgf/cm^{2}G for safety. N_2 gas in the expansion tank gives pressures of 4.5±0.1 kgf/cm^{2}G to the water for that purpose, and the thermal expansion of the water is compensated by a expansion tank. A total pressure loss for the system of one heated water circuit(half-cell) is about 2.5 kgf/cm^2, therefore the hydraulic pressure of heated water should be increased up to about 7.0 kgf/cm^{2}G by pump. To increase the temperature up to 150 ℃, the water is

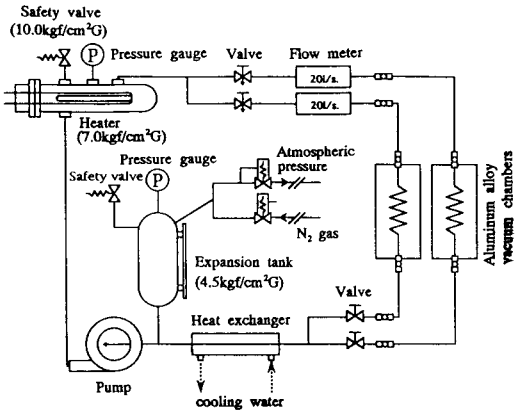

Fig.1. Diagram of the HWU.

transferred to the heater. The heater power is adjusted to keep the bakeout temperature of chamber.

Figure 2 shows the input power to the heater and the temperature of chamber during the bakeout period. The bakeout temperature is increased at the rate of 20 ℃ per hour. The temperature of chambers could be controlled within 150± 5℃ during bakeout without overheating.

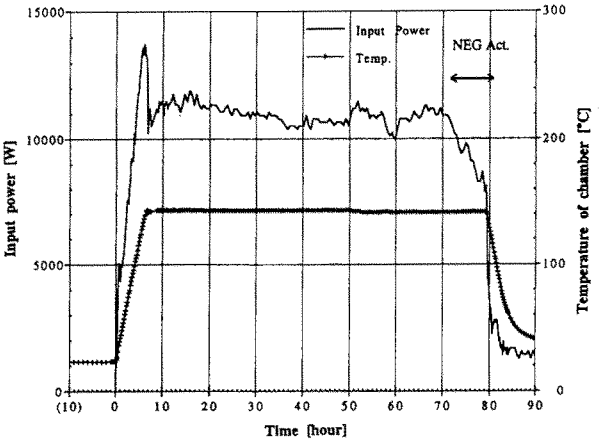

Fig.2. Chamber temperature and heater power of HWU at the bakeout.

The bellows of the chambers, gate valves, sputter ion pumps, lumped NEG pumps etc. are heated electrically. When NEG activation was carried out at the last stage of the bakeout period, the temperature of chambers had been kept at 150 ℃ by decreasing the input heater power of the HWU.

We carried out successfully the bakeout of the vacuum chambers of one unit cell (which was temporally assembled in the test room [3]) using HWU's, and confirmed the performance of the HWU at the use of the bakeout procedure in the actual ring.

References

[1] H.Schuhbäck/SL-MR, CERN-AT-VA/90-17(1990).

[2] S. Takahashi et al., RIKEN Accel. Prog. Rep., 24, 185 (1990).

[3] H. Ohkuma et al., in this issue of the SPring-8 Annual Report.