Preliminary Test of Chillers for RFQ and MEBT at KOMAC

Dong-Hyuk Seo*, Seong-Gu Kim, Kyung-Tae Seol, Han-Sung Kim, Hyeok-Jung Kwon, Yong-Sub Cho
KOMAC, KAERI, Gyeongju 226-1, Korea
seodh@kaeri.re.kr

1. Introduction

100MeV proton linac placed in KOMAC (Korea Multi-purpose Accelerator Complex) has been operated and provided to beam users [1]. RFQ (Radio-Frequency Quadrupole) which is the one of important components in 100MeV proton linac accelerates proton from 50keV to 3MeV with 350 MHz RF (Radio-Frequency) [2]. The RFQ chiller is operated for cooling the RFQ, and the cooling water temperature affects phase and amplitude of RF in RFQ. The cooling water temperature should be controlled accurately to maintain phase within 1° and amplitude within 1% from set points [3]. There are two RF systems for MEBT (Medium-Energy Beam-Transmitter) [4]. Using two MEBT chillers, the cooling water temperature for MEBT can be maintained the set point temperature. In this paper, preliminary test of chillers for RFQ and MEBT and its result are presented.

2. Chillers for RFQ and MEBT

2.1 Specification of the chillers

To remove the heat dissipation of RFQ, the chiller should remove the heat dissipation more than 30857 kcal/hr. Table 1 is the specification of the RFQ chiller. The RFQ chiller has cooling capacity of 37500 kcal/hr. Its compressor power is 11.25 KW, heater power is 20kW and pump power is 2.2 kW. Its flow rate of cooling water is 250 LPM with 4kg/cm2. It is used R-22 for refrigerant. The cooling water temperature can be controlled from -10℃ to 50℃.

Table I: Specification of the RFQ chiller

Cooling capacity	37500 kcal/hr
Compressor power	11.25 kW
Refrigerant	R-22
Pump power	2.2 kW
Heater power	20 kW
Flow rate	250 LPM
Water pressure	4 kg/cm2

To remove the heat dissipation of MEBT1 and MEBT2, the chiller for MEBT1 should remove the heat dissipation more than 2657 kcal/hr and 1886 kcal/hr for MEBT2. Table 2 is the specification of the MEBT chillers. Both chillers have same specifications. The MEBT chiller has cooling capacity of 2800 kcal/hr. Its compressor power is 0.75 KW, heater power is 2 kW and pump power is 1.3 kW. Its flow rate of cooling water is about 40 LPM with 4 kg/cm2. One is used R-22 for refrigerant and the other is used R-404a. The cooling water temperature can be controlled from -10℃ to 50℃.

Table Ⅱ: Specification of MEBT chillers

Cooling capacity	2800 kcal/hr
Compressor power	0.75 kW
Refrigerant	R-22 / R-404a
Pump power	1.3 kW
Heater power	2 kW
Flow rate	40 LPM
Water pressure	4 kg/cm2

2.2 Install chillers

Chillers of RFQ and MEBT were installed in klystron gallery where is placed in the second floor of accelerator building at KOMAC. Figure 1 is the picture of chillers. Each chiller is connected with pipe from chillers to RFQ and MEBT which are in the first floor of accelerator building (accelerator tunnel). They are operated manually, but the set point of cooling water temperature can be changed in control room with remote.

Fig. 1 The picture of chillers

2.3 Preliminary test of chillers

Chillers were operated after setting the RF only in RFQ. The temperature of RFQ chiller was set 39.8℃ and each MEBT chiller was set 27℃. Figures, from figure 2 to figure 4, are graphs of cooling water temperature about chillers. Temperatures were determined from 1 PM to 6 PM on 10th march 2016. All of the chiller was operated with accurate control of the water temperature within ±0.1~0.2℃.

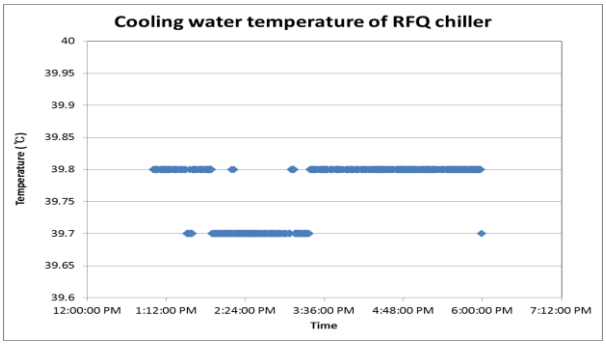

Fig. 2 The graph of cooling water temperature for RFQ chillers

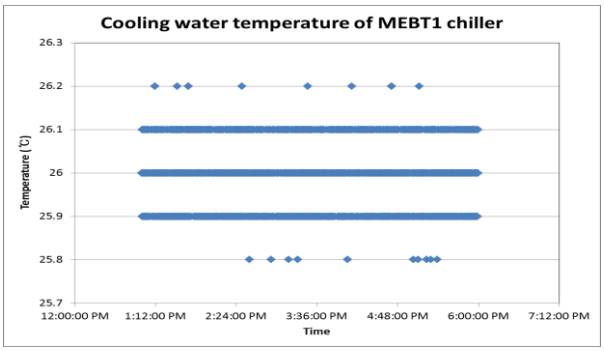

Fig. 3 The graph of cooling water temperature for MEBT1 chillers

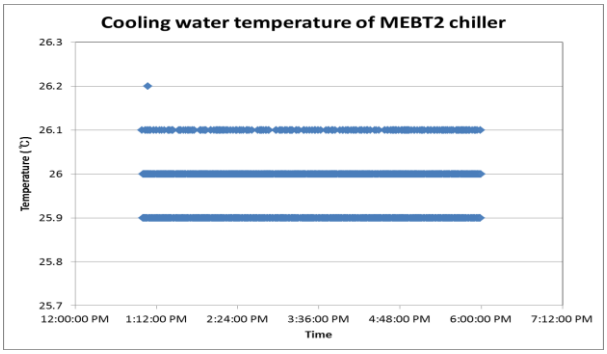

Fig. 4 The graph of cooling water temperature for MEBT2 chillers

3. Conclusions

RFQ chiller and two MEBT chillers (MEBT1, MEBT2) were operated with accurate control of the cooling water temperature within ±0.1~0.2℃. The chiller can maintain the set point of temperature by using the PID controller. To control the cooling water temperature accurately with more heat load, it is important to figure out the characteristic of PID control of chiller. In the future, a characteristic test of PID control for chillers will be performed.

Acknowledgment

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