Design of Vacuum Chambers for the Long Straight Cell

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In the SPring-8 storage ring, there are four long straight cells about 30 m long, which are equivalent to a normal cell with two bending magnets removed and are unique as compared with other synchrotron radiation (SR) facilities. If all quadrupoles and sextupoles in the long straight cell are rearranged to make free space for insertion devices (ID's), unique experiments will be possible.

The vacuum components at the long straight cell is as shown in Fig. 1. In this report, we describe the design concepts of vacuum chambers for the long straight cell, especially stressed on the similarity and difference from a normal cell.

(1) Layout of the vacuum chambers

We designed the layout of vacuum chambers similar to that in a normal cell[1]. However, since there are no bending magnets in this cell, vacuum chamber for bending magnet (BMC) and crotch (CR) were replaced by dummy chamber of the BMC (BMD) and that of the CR (CRD), respectively.

(2) Similarity on manufacture

We tried that the method of the manufacture of vacuum chambers for the long straight cell became identical with that of the normal cell's as much as possible. For example, the chamber extrusion for the BMD and the CRD are the same for straight section chamber (SSC) and bellows section chamber (BEC) made of aluminum alloy, respectively. The absorber (AB) in the SSC_L, which means a straight section chamber (SSC) for the long straight cell, is basically the same as the AB2 used in the normal cell. The AB in the BM1D is also the same as the AB2. The similar parts are used in the SSC_L and the BMD at the each upstream section. At the CR1D and the CR2D section, the BE5C and the BE2C of the normal cell are used, respectively. Those are called BE5C_L and BE2C_L in the long straight cell.

(3) Small-sized bellows

If the same large-sized bellows as in the normal cell were used, vacuum chambers and supports had to be reinforce to overcome atmosheric pressure[2].

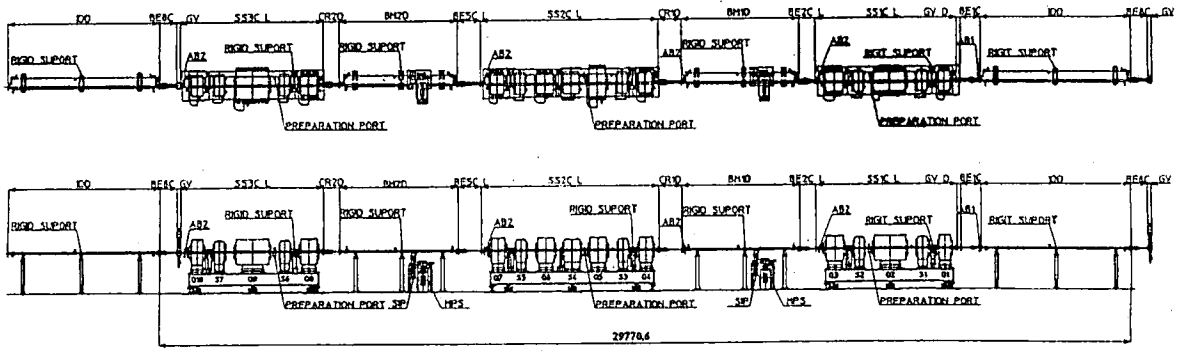

Fig.1 Layout of the long straight section cell.

ID's for long straight cell are not designed yet. Since the vacuum chamber for ID may have a thin wall, we design to use the same small-sized bellows of the CRD as of the BEC made from aluminum alloy in order to suppress the stress of vacuum chambers and supports due to atmospheric pressure.

(4) Absorber

In order to get a horizontal clearance space, namely larger than about 5mm, between the inner surface of vacuum chamber and SR, we installed four AB's at the downstream of SSC_L's and BM1D. SR power irradiated on the AB of SS2C_L, SS3C-L or BM1D is less than that irradiated on the AB2 of SS1C for the normal cell. Therefore,we decide to use the AB2 for the normal cell as AB's for the long straight cell.

(5) Pumping system

The main pumping system is distributed non-evaporable getter (NEG) pumps which are installed in SSC_L, BMD and IDD. Bending magnets are not in this cell, so there are no distributed ion pumps. Therefore, in order to exhaust methane or argon which the distributed NEG pump cannot exhaust, the sputter ion pumps are used at the BMD locations. Since a little amount of SR incident on AB's, we have no special pumping system such as a lumped NEG pump provided on CR and AB locations of the normal cell to exhaust gases due to the photodesorption.

During the bakeout and NEG activation in this unit cell, two movable rough pumping systems (MPS's) are used. It is, however, feared that only two MPS's are not enough to exhaust the vacuum chamber, so we prepared a additional pumping port on each SSC_L.

References

[1] SPring-8 PROJECT, PART1, FACILITY DESIGN 1991 [REVISED], pp2-114

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