§14. Construction of Fast-wave ICRF Antenna for the LHD


Fast-wave ICRF antennas were designed and constructed\(^1\). One pair of the antennas will be inserted from the top and the bottom vertical ports of the LHD. Inside the chamber, loop section is located at the outward side of the toroid. The antenna has strong cooling channels for long pulse operation. The steady state technology obtained in the R&D was fully incorporated in the design of the LHD loop antenna. The photograph of the loop antennas which were placed in the supporting frame for fabrication are shown in Fig. 1. The right side one is the upper loop antenna and the left side one is the lower loop antenna. On the upper one, the carbon side protectors and the divertor leg protectors are attached.

The enlarged photograph of the loop section is also shown in Fig. 2. The shape is designed to fit the outer boundary of the scrape off layer. Current strap is single loop and have the quite wide width of 30 cm. The height of loop section is 60 cm and the width including the carbon side protectors is 50 cm. The Faraday screen pipes are made by stainless steel and fitted to the line of the force of the confining magnetic field.

These antennas have long vacuum feeding line from the feedthrough section. The total length inside the vacuum chamber is 3.2 m. The launcher section changes its position for more than 15 cm by the swing motion.

The antennas are designed to operate for more than 30 minutes with 40 kV at the highest voltage position. To remove the dissipated RF loss power on the conductors and the incoming plasma heat load on the Faraday shields and the side protectors, there are many cooling water channels in the structure. In Fig. 3, the drawings of the cross sections of the antenna loop are shown.

![Fig.1 Photograph of the LHD fast wave antennas with holding frame structure. Right side one is top port antenna and left side one is bottom port antenna.](image1)

![Fig.2 Photograph of loop section of the LHD fast wave antenna.](image2)

![Fig.3 The drawings of the cross section at different altitudes. Z is the distance from the equatorial plane.](image3)

Reference