§15. Test Facilities of the Experiments on a Single Inner Vertical Coil (EXSIV) for the Large Helical Device

Mito, T., Takahata, K., Satow, T., Satoh, S., Nishimura, A., Yamada, S., Yanagi, N., Chikaraishi, H., Iwamoto, A., Maekawa, R., Tanahashi, S., Motojima, O., Yamamoto, J., EXSIV Group

The test facilities of the Experiments on a Single Inner Vertical coil (EXSIV) and their performances were reported. The IV coil is the smallest poloidal coils of the Large Helical Device (LHD) and its inner and outer diameter are 3.2 m and 4.2 m respectively. The IV coil was installed in a single-coil-test cryostat and was connected to the test facilities; such as, a supercritical helium centrifugal pump, a superconducting bus-line, a helium refrigerator as shown in Fig.1. The coil was cooled by the temperature controlled helium gas, mixing cold and warm gases in the helium refrigerator. According to the programmed refrigeration mode of about 1 K/h, the cool-down of the coil was completed within 250 hours with the temperature difference between the inlet and outlet of the coil was maintained less than 50 K. After the cool down, the coil was isolated from the refrigerator and was cooled by the circulation of supercritical helium using the cryogenic centrifugal pump with mass flow rate of 50 g/s. This centrifugal pump have been very stable even after the shut-off tests of the coil current from 20.8 kA. The superconducting flexible bus line, 20 m long and nominal current of 30 kA, was cooled by the forced-flow two phase helium, which demonstrated the feasibility of superconducting current feeders for LHD. Overall heat loads were removed by the helium refrigerator with its capacity of 600 W at 4.4 K. After improvements of some difficulties with the test facilities: malfunction of the control valves caused by magnetic fields; the blockage of the coil inlet-filter caused by contamination in the helium gas, the coil was successfully energized to the nominal current of 20.8 kA.

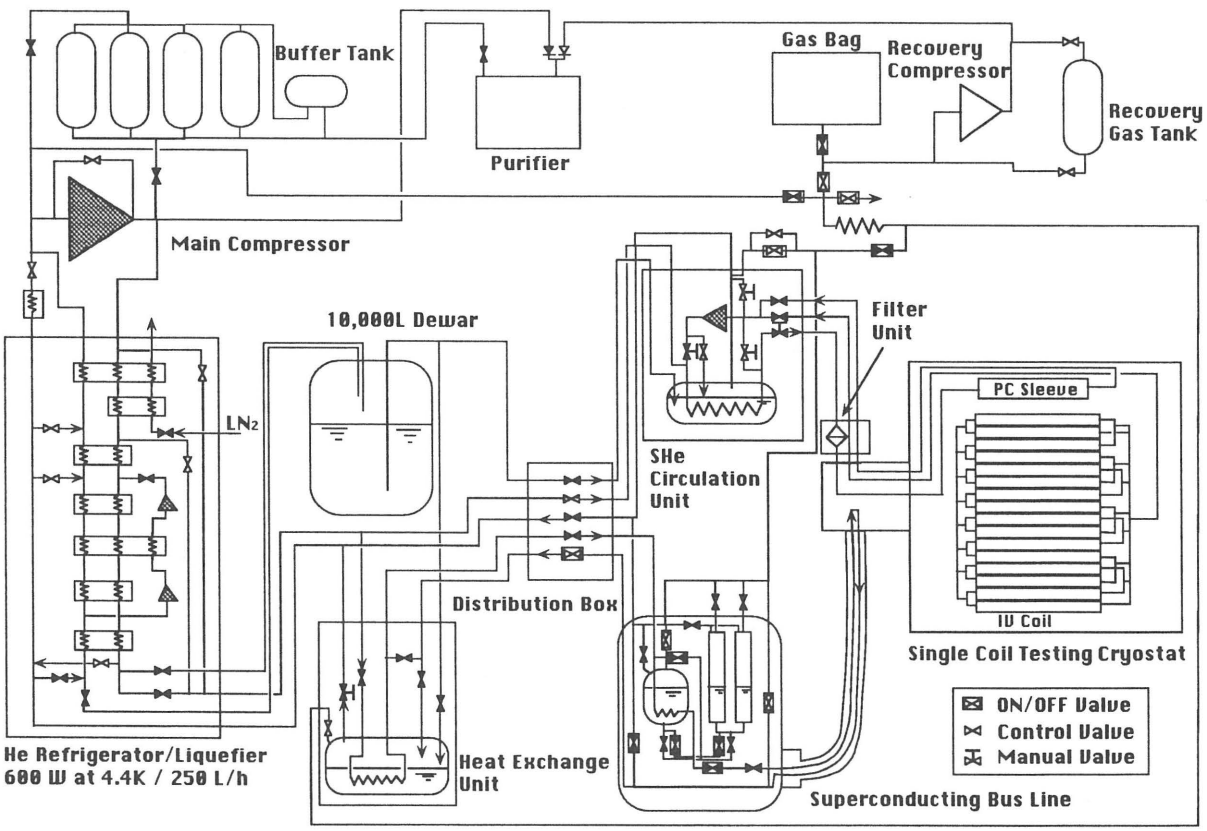

Fig. 1. Flow diagram of the EXSIV test fascilities.