

ITER中性粒子入射装置用超高压電源調達の進展
Progress of procurement on the ITER NB ultra-high voltage power supply

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A high-energy and high power neutral beam injectors (NBI) of 1 MeV, 16.5 MW neutral power/injector are required for plasma heating and current drive in ITER. A Neutral Beam Test Facility (NBTF), which has the same capacity as the ITER NBI, is constructed at the RFX site in Padua of Italy to demonstrate the specifications and to establish its operation techniques. Capacity of the power supply is DC -1 MV and 60 MW for the beam source with pulse duration up to 3600 s. JAEA as Japan Domestic Agency (JADA) provides ultra-high voltage components of a DC -1 MV power supply for NBTF. To fabricate such UHV NBI power supply components, detailed design has been conducted.

The design of the main components is outlined and key points are also described as follows. Design of DC filter, Test power supply(TPS), Transmission line (TL), High voltage deck (HVD) 2, dummy load and shirt circuit device were finished, and design of DCG's and Insulating transformer is still ongoing.

A TL from a DC filter to a HV bushing contains five inner conductors of dc -1 MV, -800 kV, -600 kV, -400 kV and -200 kV for a beam accelerator. Power supply cables for an ion source are joined at midpoint of TL1&2 from HVD1 (EUDA). Cooling water and H₂/D₂ gas are supplied from the HVD2 where a water choke insulation tubes (alumina ceramics) are installed.

The transmission line and the HVD2 are filled with

a 0.6 MPa SF₆ gas for insulation. Arrangement of these conductors and pipes in the transmission line and HVD2 has been designed with using electric field analysis code. Electric field was designed to be lower than the allowable value of 20 kV/mm in SF₆ gas of 0.55 MPa. The design results shows that the most concentrated parts is 13.1kV/mm. It was confirmed that there is a margin of insulation.

A surge protection system is one of the most important systems to reduce the input energy to the accelerator to avoid voltage degradation by breakdowns. A surge blocking core has been designed to reduce the input energy lower than 50 J. It was confirmed that surge energy is suppressed to be around 26 J by circuit analysis.

A DC filter has been designed to suppress over voltage and ripple. Output voltages and currents measurement system are installed in the DC filter tank.

Schedule of the power supply manufacturing and construction is shown in Fig. 2. Final design review of DC filter, TL1,2,3 HVD2 dummy load, TPS, shirt circuit device for site test by ITER has been finished and JADA moves to manufacturing phase. All procurement activities are ongoing toward the acceptance test in 2017

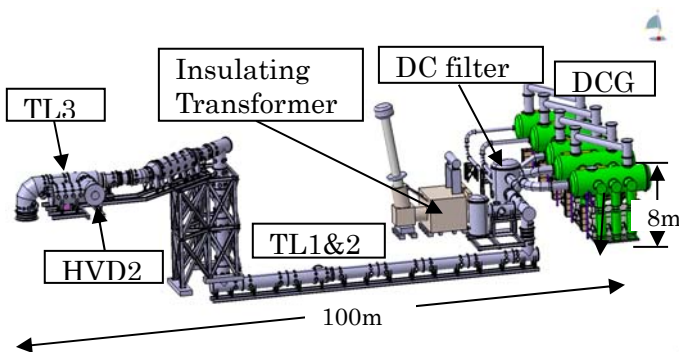


Fig. 1 ITER NB power supply UHV components

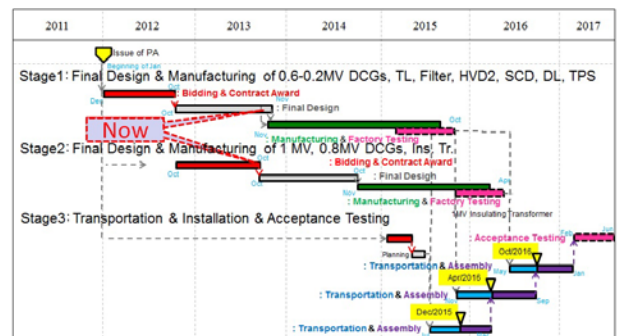


Fig. 2 Schedule of procurement on the NBTF power supply