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P3.010 Design and manufacturing of thermal shield for JT-60SA

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In order to reduce thermal radiation to cryogenic components, vacuum vessel (VV), ports and cryostat are covered with thermal shield in JT-60SA. The design requirements are follows;

- Surface temperature shall be < 100K during operation and < 140K during VV baking.
- It should have integrity against electro-magnetic force during plasma disruptions and seismic load (0.6G in horizontal and 0.4G in vertical).
- It should have enough clearance for displacement of each components.

Thermal shield is designed to satisfy above requirements as follows. It consists of VV thermal shield (VVTS), port thermal shield (PTS) and cryostat thermal shield (CTS). They are fabricated each toroidal 20 degree sectors in factories and assembled on-site. They have double wall structure made of SS316L. Cooling pipes between walls are cooled by 80K He gas at 1.8 MPa. Each sectors has two cooling channels for redundancy. Outer surface of CTS is covered with multi-layer insulations. VVTS and CTS have electric insulations at each 20 degree in toroidal direction to reduce electro-magnetic force. Vertical load is hung from toroidal field coil cases by 18 rods. Horizontal load is supported from cryostat body with 27 stays. Special shapes are adopted at 8 of 18 sectors to keep required clearance to tangential horizontal ports and oblique ports for NBIs.

The VVTS and PTS except for 8 special shape horizontal PTS have been fabricated. Fabrication tolerances were within +/-5mm for inboard VVTS and PTS, +/-10mm for outboard VVTS. Pressurized test at 2.5MPa and He leak tests less than 10^{-8} Pam³/s were passed twice, after welding between cooling pipes and inner plate and after closing outer plate in factories. 340 degree of VVTS and lower PTS have been assembled on-site. Each 20 degree sector were connected customized mechanical couplers and radiation covers to keep required clearance around them.

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