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Wed-Mo-Po3.03-01 [17]: Design of JT-60SA Cryodistribution components

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JT-60SA is a fusion experiment tokamak device using superconducting magnets to be built in Japan. This joint international project involves Japan and Europe. In this work, we presents the design of cryodistribution and its components which are composed of a main transfer line (TL) and valve boxes (VB).
Five coolant loops are distributed between a helium refrigerator system (HRS) and cold components. Super critical pressure helium (SHe) of 4.5 K and 0.5 MPa supplied to 18 toroidal field coils, 6 equilibrium field coils and 4 central solenoid modules (LOOP1 & 2). SHe of 3.7 K and 0.5 MPa is supplied to divertor cryopumps (LOOP3). Gaseous helium (GHe) of 80 K and 1.4 MPa is supplied to radiation thermal shields (LOOP4). GHe of 50 K and 0.4 MPa is supplied to cold ends of high temperature superconducting current leads (LOOP5).
TL is a vacuum heat-insulation multiple piping, of which the length is about 45 m, and connects between HRS and the tokamak cryostat. All 5 supply lines, 4 return lines and 2 control valves are installed in TL. The outer vacuum pipe diameter is 965.5 mm and the inner coolant pipe diameter are 108.3 mm for LOOP 1/2/4 and 59.0 mm for LOOP 3/5. A vacuum partition between HRS and the tokamak cryostat is located near the middle of TL in a longitudinal direction.
VB contains cryogenic valves and measurement devices to control the cold helium flow. Eleven VBs are installed around the tokamak cryostat. Dimensions of VB body are 2 m in height and 1.4 m in diameter. Almost all cold helium lines from HRS are firstly into VBs through TL. Impulse lines, orifice plates, and resistor elements are installed at the pipes in VB for measurement of the pressure, the flow rate, and the temperature of coolant helium.

Primary authors: Dr NATSUME, Kyohei (Quantum radiology Science and Technology); Mr FUKUI, Kazuma (National Institutes for Quantum and Radiological Science and Technology); Dr MURAKAMI, Haruyuki (Quantum radiology Science and Technology); Dr KIZU, Kaname (Quantum radiology Science and Technology); Dr ISONO, Takaaki (Quantum radiology Science and Technology)

Presenter: Dr NATSUME, Kyohei (Quantum radiology Science and Technology)

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