TPX DIVERTOR DESIGN*

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The TPX tokamak requires a symmetric up/down double-null divertor capable of operation with steady-state heat flux as high as 7.5 MW/m^2. The divertor is designed to operate in the radiative mode and is of the deep slot configuration with gas puffing lines to enhance radiative divertor operation. Pumping is provided by cryopumps that pump through 8 vertical ports in the floor and ceiling of the vessel. The plasma facing surface is made of carbon-carbon reinforced composite blocks (macroblocks) bonded to multiple parallel copper tubes which are oriented vertically. Water flow at 6 m/s is used with the critical heat flux (CHF) margin improved by the use of enhanced heat transfer surfaces. In order to extend the operating period where hands on maintenance is allowed and to also reduce dismantling and disposal costs, the TPX design emphasizes the use of low activation materials. The primary materials used in the divertor are titanium, copper, and carbon-carbon reinforced composite. The low activation material selection and the planned physics operation will allow personnel access into the vacuum vessel for the first 2 years of operation. This 2-year period will allow final in-vessel checkout of the remote handling equipment. The remote handling system requires that all plasma facing components are configured as modular components of restricted dimensions with special provisions for lifting, alignment, mounting, attachment, and connection of cooling lines and instrumentation and diagnostics services. Alignment of the plasma facing surface to the as-built magnetic field and to neighboring modules is critical to limit peak temperatures and limit carbon impurities in the plasma. Both local edge-to-edge and overall alignment of the divertor is accomplished using a machined alignment ring system. This ring system maintains the modules in a circular array and is adjusted during machine assembly to align with the as-built magnetic field. Surface erosion of the carbon-carbon reinforced composite is expected to average a millimeter per year. The macroblocks have 10 mm of carbon-carbon protection for the copper tubes, of which 7 mm is considered erosion allowance. The divertor modules must form a sealed system with a particle leakage allowance of 8500 liters/second of neutral particles which otherwise might reenter the plasma and degrade performance.

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