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P3.149 Design and manufacturing of the wendelstein 7-X cryo-vacuum pump

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The cryo-vacuum pump (CVP) system, consisting of 10 units distributed symmetrically inside the Wendelstein 7-X plasma vessel, will be installed together with the 10 units of the actively cooled high heat flux divertor. One pump each is located below the corresponding divertor, and positioned as close as possible to the flux line strike points in order to allow efficient control of plasma density and for screening impurities. Each CVP is divided into two parts, interconnected by a transfer line, to ensure access for divertor diagnostic integration. The CVP panels are operated with supercritical helium at 3.3-3.8K to pump discharge gases such as He, H2 and D2. They are protected against thermal radiation by black-oxide finished stainless steel chevrons operated with liquid nitrogen at 77K. In front of this LN2-shield is a water-baffle which protects the CVP against plasma and ECRH stray radiation. It consists of copper chevrons with zero overlap, mounted on a water-cooled steel pipe. These chevrons are coated with a Al2O3-TiO2 layer. In addition, an uncooled copper shield covers the gap between water-baffle and LN2 chevrons in order to prevent stray radiation to take this path to the He-cooled panel. The cryogenic fluids are supplied via a dedicated port plug-in which is thermally insulated by a LN2-cooled cryo shield and superinsulation. All 10 CVPs have already been manufactured and successfully leak tested under hot and cold conditions in the workshops of IPP Garching.
This paper presents the design and the manufacturing technology of the CVPs and the adjacent periphery. Results of the quality assessment such as integral He leak testing at 160℃ and cryogenic temperatures (-196℃) are also discussed.

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