

ITER NEUTRAL BEAM CRYOPUMPS DESIGN REQUIREMENTS FOR THE INTEGRATION

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The ITER Neutral beam injectors are one of the main heating systems for the DT plasma operations in ITER. The systems are characterized by high gas flows from different beam line components against which the cryopump must maintain a pressure between 10^{-2} and 10^{-3} Pa.

The cryopump design for the ITER Heating and Diagnostic neutral beams were initially developed mainly to cope with heat load and vacuum pumping requirements in the beam lines. The integration of the cryopumps in the ITER Neutral Beam port cells has now been performed with detailed investigation of the interfaces with crane facilities and installation tools. As a result of this work the mechanical stress analyses with finite element methods showed that a complete reinforcement of the cryopump support structure had to be done.

In order to meet ITER Vacuum standards for high reliability and availability as detailed in the ITER Vacuum Handbook the pump has also been redesigned to minimise the use of cryogenic corrugated hoses. To cope with this requirement the concept of the supports of the pumping sections have been completely redesigned to give hanging sections which have minimum constraints avoiding any corrugated hoses or bellows.

The cryopumps will be supplied by the ITER cryogenic plant via the cryogenic valve boxes of the front end cryodistribution system. The cryogenic valve boxes and cryopumps are connected via flexible lines with Johnston Couplings. The cryo-feed in the beam line vessel walls have been designed as one common flange comprising all required feedthroughs for the cryopumps. These are the 4.5 K and 80 K go- and return-lines, the feedthrough for sensors and burst line outlets for the cryogenic circuits. A detailed installation sequence is presented showing the handling of the large cryopump of 8m length and 2.8m height and its complex cryogenic interface within the beam line vessel.

The paper describes the requirements from the installation and the remote handling maintenance on the cryopumps accompanied by an outline of the consequences on the design. Further the most actual operational requirements for the ITER Heating and Diagnostic Neutral Beam cryopumps will be summarized.

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