

HF-launcher system of the gyrotron set-up of the T-15MD tokamak on the first stage operation

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At the current time, the preparatory stage of work for experiments on T-15MD tokamak is underway at the National Research Center «Kurchatov Institute». Important step in this stage is building-up of the gyrotron set-up and assembling of HF-launcher for electron cyclotron resonance (ECR) heating plasma. During commissioning works, due to the reduced power supply, the T-15MD will operate with relatively low magnetic fields (toroidal magnetic field in the center of the plasma $B_{tor}(r/a = 0) \approx 1.5$ T). Therefore, the gyrotron frequency is selected to be 82.6 GHz. The output power of the gyrotron is 1MW with 30 s maximum pulse length. The experiments are supposed to be carried out on the second harmonic of an extraordinary wave when microwave radiation is introduced from the outside of the vacuum chamber (resonance at $B_{tor} \approx 1.5$ T). The HF-power is transported from gyrotron to the tokamak via evacuated 35 m long corrugated waveguide with inner diameter 63.5 mm.

The main task of the T-15MD gyrotron complex at the first stage operation is the breakdown of the working gas. The input system allows focusing the wave beam, and in the focusing area the power density in the cross section reaches values $\sim 0.20\text{--}0.25$ MW/cm², which is similar to that of in the successful breakdown experiments on the T-10 tokamak. The last mirror of the HF-launcher system is capable of deflecting the beam in the toroidal and poloidal directions within ($\pm 25^\circ$) and (-5°) \div ($+35^\circ$) subsequently. This gives flexibility to experiments, both on breakdown and to other tasks of ECR heating and maintenance of current drive by electron-cyclotron waves at the quasi-stationary stage of discharge.

Under breakdown conditions on the side of a strong magnetic field ($B_{tor}(r/a = 0) = 1.3$ T), electrical system of T-15MD allows to raise the magnetic field during discharge, moving the heating to the center.

Keywords: gyrotron, ECRH, breakdown, HF-launcher.

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