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DEVELOPMENT OF A HIGH FREQUENCY PLASMA DRIVER FOR HEATING ATOMIC INJECTORS WITH MULTI-SECOND OPERATION DURATION *)

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Neutral beam injection is one of the main methods of heating plasma in fusion facilities with magnetic confinement. A beam of atoms is created by accelerating ions and then neutralizing them. At the Institute of Nuclear Physics. G.I. Budker SB RAS developed a series of heating injectors [1]. It is promising to use a radio-frequency (RF) plasma driver as a plasma generator in an ion source [2]. Ion sources based on RF drivers do not have incandescent elements and therefore have stable emission parameters in multi-second pulses. The driver has a ceramic vacuum chamber, inside of which an induction discharge is maintained. The plasma generated in the RF driver affects the main parameters of the beam: current, composition, homogeneity. To prevent overheating and erosion of the ceramic wall of the driver, a protective cylindrical screen with longitudinal slits is inserted inside. Such screen reduces the power transfer efficiency into the discharge. The paper compares the characteristics of a RF driver developed for a heating injector of high-energy neutrals [3] with the characteristics of a driver developed for a diagnostic injector. Based on the comparison, recommendations are given on designing a more optimal RF plasma driver.

We obtained the ion current density at the driver output as a function the RF power. We also measured thermal loads and temperature of the protective screen and the RF driver elements during 30 seconds long pulses. The basic requirements for the design of an RF driver for multi-second operation have been determined. The work was carried out with the support of the Ministry of Science and Higher Education of the Russian Federation.

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