

ECH MW-level CW Transmission Line Components Suitable for ITER

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The ECH transmission lines for ITER will require performance parameters not yet entirely demonstrated in ECH systems on present magnetic fusion energy machines. The key performance requirements for the main ITER transmission lines are operation at 1 MW for pulse lengths of 400 s up to 3600 s (essentially cw) at a frequency of 170 GHz. An additional consideration for transmission line performance is the possibility that ITER will use 2 MW coaxial cavity gyrotrons currently under development by Forschungszentrum Karlsruhe (FZK) and other European Associations and European tube industry. This paper addresses the progress made by General Atomics in the various transmission line components suitable for use on ITER at 170 GHz, as well as at 120 GHz for plasma startup. ITER design documents call for a corrugated waveguide inner diameter of 63.5 mm; many components have already been fabricated in this diameter, and those that have been made in other diameters (namely 31.75 mm and 88.9 mm) can readily be modified to a 63.5 mm i.d. design. In some cases, water cooling must be added to present designs to remove heat deposited during cw operation of the components.

In addition to the main transmission lines, there are corrugated waveguide components incorporated into the ECH launcher systems (equatorial and upper launchers). The status of the development of these components, including remotely steerable launcher components, is also presented.

This paper focuses on those components needing design modifications to meet ITER requirements (i.e. frequency, power level, pulse length, diameter). The heat loads and resultant temperature increases for critical components are estimated. For those components whose temperatures will exceed safe limits, design changes already underway or planned will be addressed. Components being designed for ITER and other cw applications include Matching Optics Units (MOUs), aluminum waveguide sections adjacent to miter bends, compact dummy loads, dc breaks, waveguide bellows, stainless steel waveguides, and remote steering launcher waveguides.