

Remote Handling behind port plug in ITER (P2-G-414)

Otto Bede(1), Heiko Neuberger(2)

1. Association EURATOM/HAS, KFKI-Research Institute for Particle and Nuclear Physics P.O. Box 49. H-1525 Budapest Hungary
2. Forschungszentrum Karlsruhe, Institut für Reaktorsicherheit (IRS) Postfach 3640 76021 Karlsruhe Germany

Different Test Blanket Modules (TBM) will be used in succession in the same equatorial ports of ITER. The remote handling operations for connection/disconnection of an interface between the port plug of the EU-HCPB-TBM and the port cell equipment are investigated with the goal to reach a quick and simple TBM exchange procedure. This paper describes the operations and systems which are required for connection of the TBM to its supply lines at this interface.

The interface is located inside the free space of the port plug flange between the port plug shield and the bioshield of the port cell behind. The approach of the operation place is only available through a narrow gate in the bioshield opened temporarily during maintenance periods. This gate limits the dimensions of the whole system and its tools.

The current design of the EU-HCPB-TBM foresees up to 9 supply lines which have to be connected inside the free space of one half of the port plug flange. The connection operations require positioning and adjustment of the tools for each pipe separately.

Despite the strict circumstances it is still possible to find such an industrial jointed-arm robot with sufficient payload, which can penetrate into the working area. A mechanical system is necessary to move the robot from its storing place in the hot cell to the port plug on 6 m distance.

Each operation requires different end-of-arm tools. The most special one is a pipe positioner tool, which can position and pull the pipe ends to each other and align the tool before welding and hold them in proper position during the welding process.

Weld seams can be made by orbital welding tool. The pipe positioner tool has to provide place for welding tool. Using of inbore tool is impossible because pipes have no open ends where the tool could leave it. Orbital tool must be modified to meet requirements of remote handling because it is designed for human handling. The coolant is helium, so for eliminating the leak of helium it is of high importance to find a safe way for weld seam audit. The installation and removal of thermal insulations around the pipes at the interface is an additional requirement which has to be met by a special tool.

With application of a fast tool changer adapter the arm can easily exchange the tools stored in the envelope area of robot.

Conceptual design is made by CAD modelling. Work area accessibility is assessed using a kinematic analysis.