

RECENT TEST RESULTS ON BLANKET MODULE INSTALLATION BY USING IN-VESSEL TRANSPORTER FOR ITER

A. Aburadani¹, N. Takeda¹, S. Kakudate¹, T. Kubo², T. Sugimoto², M. Nakahira³, and A. Tesini³

¹ Japan Atomic Energy Agency

² Toshiba Corporation

³ ITER Organization

Corresponding author: aburadani.atsushi@jaea.go.jp

Maintenance of ITER blanket is carried out in the vacuum vessel (VV) by the remote handling equipment, i.e., in-vessel transporter (IVT) with vehicle type manipulators^[1]. The number of the blanket modules (max. weight of 4.5 ton) is about 440 and installed in the VV. The dose rate of gamma ray is expected about 500 Gy/h during blanket maintenance. Blanket modules are installed on two keys that are part of VV. The modules are designed to mitigate the large electro-magnetic loads that occur during plasma disruptions

Blanket maintenance requires the remote manipulation of the four-ton modules and specifies that final installation accuracy be within 0.5 mm between the module and the two key supports in the VV. The critical issues are:

- 1) to position by sensor based control before key insertion
- 2) to avoid any jamming between the blanket module and the keys as a result of excessive loading during the module installation process, a process complicated by the limited clearance of 0.5 mm between the module and the keys.

Sensor based control for remote installation of blanket module was carried out using a combination of distance sensor for rough positioning and contact sensor for fine positioning^[2]. This sensor based control can't obtain the visual information during blanket module installation to use distance sensor without visual function. Therefore, we have developed the sensor based control using camera by a monocular vision method to measure the relationship of relative positioning between key and blanket. As a result, the variations of the positioning accuracy were about +10 mm, -10 mm and 3 mm in the x, y and z-axes, respectively.

To avoid any jamming, torque control is developed to decrease excessive loads which may impact the end-effector. This torque shows the effect to avoid jamming during key insertion. Pitch axis of for end-effector move to decrease the excessive loads on manipulator. As a result, the final installation to within 0.5 mm between the module and two keys have been demonstrated by using torque control as shown in Fig.1.

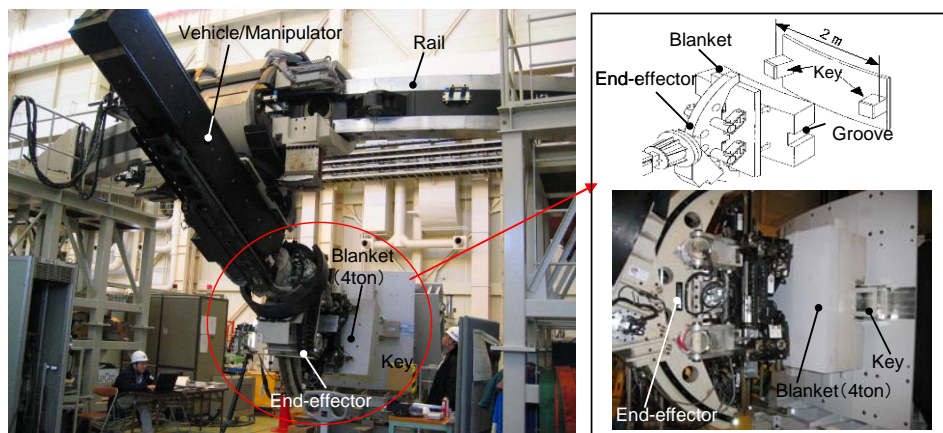


Fig.1 Blanket installation

[1] N. Takeda, et al., Fusion Engineering and Design, Vol.83, pp.1837-1840(2008)

[2] S. Kakudate, et al., Fusion Engineering and Design, Vol.65, pp.33-38(2003)