UPPER PORT PLUG HANDLING CASK SYSTEM ASSESSMENT AND DESIGN

PROPOSALS

J.W. Pustjens¹, J.P. Friconneau³, C.J.M. Heemskerk², J.F. Koning², J.P. Martins³, P.C.J.N.

Rosielle¹, M. Steinbuch¹

¹ Eindhoven University of Technology, Eindhoven, The Netherlands ² FOM Rijnhuizen, Nieuwegein, The Netherlands ³ Iter-IO, Saint Paul lez Durance Cedex, France

Corresponding author: j.pustjens@student.tue.nl

The Cask and Plug Remote Handling Systems shall provide the means for the remote transfer of (clean/activated/contaminated) in-vessel components and Remote Handling Equipment between Hot Cell Facility and Vacuum Vessel through dedicated galleries and lift in the ITER buildings [1].

The CPRHS for Upper Port Plugs (UPP) has three distinct docking interfaces at the VV, being: Building, Docking Flange and Plug Flange. The current design assumptions lead to a solution composed of several modules (air transporter, pallet, cask envelope, ramp and tractor), which together fulfill the containment, exchange and transportation requirements. Each module has at least six degrees of freedom (d.o.f.) to be statically determined; leading to a superfluous number of d.o.f.'s to be actively or passively constrained. The result is a complex design that has to fit in a limited space, having relatively long force loops. The need of compactness has led to a design containing mechanical features that may result in inadequate behavior, like lack of accuracy, position hysteresis, unnecessary wear and jamming. This has consequences on reliability, availability and safety. Careful reduction of the number of d.o.f.'s represents an opportunity to relax the tolerances in the design, resulting in cost optimization and reliability increase.

Novel design concepts are proposed at both the system scope and the module scope. A modified kinematical design for the tractor module is suggested. At the system level a semipermanent mechanical guidance is proposed in the Port Duct to simplify docking and prevent the risk of the Cask tilting. The benefits of a non-cantilevered handling system are reviewed. An overview of conceptual design solutions is given, with a rationale to select specific design solutions.