Implementation Plan for the Design of ITER Vacuum Vessel and Thermal Shield

S. Cho, K. I. Im, C. S. Kim, G. S. Lee, D. I. Choi
ITER Project Task Force Team, 52, Yeoeun-Dong, Yusung-Gu, Daejeon, 305-333, Korea, sycho@kbsi.re.kr

1. Introduction

The conceptual design of the vacuum vessel and thermal shield has been already developed. Detailed design has been performed for the vacuum vessel except some components. Among them, the port and in-wall shielding need to be designed in detail. In this paper the methodology of implementation of the detail design of these components will be mentioned. For the thermal shield, detailed design has not been performed deeply. It needs a manufacturing feasibility study of the conceptual design. In this paper, the methodology of implementation of the feasibility of these components will be addressed

2. Design of Port and In-Wall Shielding

The configurations of vacuum vessel port and in-wall shielding are shown in Fig. 1 and 2. The port components to be developed are the stub extensions, the port extensions, and the connecting ducts. The conceptual design of the in-wall shielding of the vacuum vessel has been also developed. The space between the inner and outer shells is filled with pre-assembled or modular shielding blocks. The in-wall shielding material is boron doped stainless steel or ferromagnetic steel. 40 mm thick flat plates will be used. These flat plates will fill 55% (inboard) ~60 % (outboard) of the volume between the vessel shells to provide an effective neutron shielding capability.

The objectives of the vessel ports are to develop the detailed design of the port structures, develop fabrication methods for the port components and study the fabrication and assembly tolerances of the port components. The detailed design of the in-wall shielding is to be developed. The support structure should be designed considering the electromagnetic loads and the assembly scheme. The structural and thermal hydraulic characteristics should be confirmed.

3. Design of Thermal Shield

The thermal shield (TS) system is required to minimize radiation heat loads and conduction from warm components to cold structures operating at 4.5 K. The TS comprises of the vacuum vessel thermal shield between the VV and the cold structure, the cryostat thermal shield covering the walls of the cryostat, the transitional thermal shields that enclose the port connection ducts and service lines, and the support thermal shields that enwrap the machine gravity supports. These panels are covered on both sides with a thin, low emissivity layer of silver to reduce the radiation heat loads.

The work that has to be done is to review in depth the proposed fabrication process as well as options of several assemblies. Based on the review, the optimum thermal shield assembly procedure will be recommend. Also, fabrication and assembly steps including details of welding and material forming operations will be developed. Finally, time schedule for the sequential steps in the implementation of the procurement contract should be developed.

4. Conclusion

Based on the conceptual design of vacuum vessel and thermal shield, important tasks required for the detailed design are addressed. The objectives and the requirements of the tasks for the vacuum vessel and thermal shield are summarized. To fulfill the detailed design the methodology of implementation of the tasks are mentioned. The main detailed design will be executed in the future.

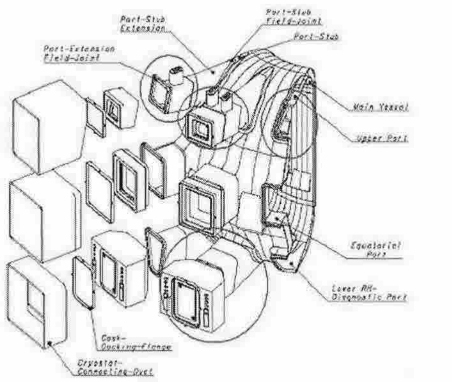

Figure 1. Port components of the vacuum vessel

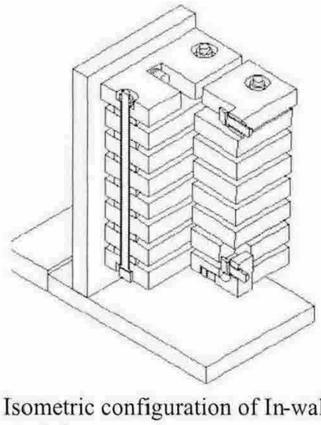

Figure 2. Isometric configuration of In-wall shielding module