

PPPL-5230

Upper Port Plug 14 Diagnostic Shielding Module (DSM) Design

A. Jariwala, R.Feder , M. Smith, ,Y. Zhai, W. Wang , T. Edgemon, L. Konkel,

February 2016



Prepared for the U.S. Department of Energy under Contract DE-AC02-09CH11466.

Princeton Plasma Physics Laboratory

Report Disclaimers

Full Legal Disclaimer

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Trademark Disclaimer

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

PPPL Report Availability

Princeton Plasma Physics Laboratory:

<http://www.pppl.gov/techreports.cfm>

Office of Scientific and Technical Information (OSTI):

<http://www.osti.gov/scitech/>

Related Links:

[U.S. Department of Energy](#)

[U.S. Department of Energy Office of Science](#)

[U.S. Department of Energy Office of Fusion Energy Sciences](#)

Upper Port Plug 14 Diagnostic Shielding Module (DSM) Design*

A. Jariwala^{a, 1}, R. Feder^a, M. Smith^a, Y. Zhai^a, W. Wang^a, T. Edgemon^a, L. Konkel^a,

^a*Princeton Plasma Physics Lab, Princeton, NJ, USA*

¹ email: ajariwal@pppl.gov

There are 12 diagnostic upper port plugs distributed around ITER vacuum vessel. Each diagnostic Upper Port Plug (UPP) consists of three major components, 1) Port Plug Structure (PPS) provides common and stable platform for variety of diagnostics. 2) Diagnostic First Walls (DFWs) protect instruments and diagnostics against high radiant and nuclear heating. 3) Diagnostic Shield Module (DSM) supports DFW and various diagnostic/instruments, provide nuclear shielding. DFW and PPS are designed by ITER Organization (IO), and have been standardized for every diagnostic port. US is responsible for designing and manufacturing customized Upper Port 11 and Upper Port 14 DSM.

Various loads influence the DSM design. Electromagnetic (EM) loads are Lorentz forces acting upon the conductive structure of the UPP during transient EM events (e.g. plasma disruption) and are design driving loads. Inertial loads are caused by accelerations due to gravity, seismic events and Vertical Displacement Events (VDEs). Thermal loads result from the radiant heat flux & nuclear heat from plasma.

The upper port DSM design and validation is based upon the ITER “Design by Analysis” method using the “Structural Design Criteria for ITER In-Vessel Components (SDC-IC)”. Current UP#14 DSM is a four plate welded structure with customized shield block mounted inside. Welded plate DSM design preserves all generic physical interfaces, satisfies DFW tab cooling guidelines, and can be easily customized for various diagnostic arrangements and their integration needs. The UP14 DSM design description and analysis for the preliminary design is presented.

*This work is supported by US DOE Contract No. DE-AC02-09CH11466. All US activities are managed by the US ITER Project Office, hosted by Oak Ridge National Laboratory with partner labs Princeton Plasma Physics Laboratory and Savannah River National Laboratory. The project is being accomplished through a collaboration of DOE Laboratories, universities and industry. The views and opinions expressed herein do not necessarily reflect those of the ITER Organization.

TOFE Track and Session: Components – In-vessel components

Oral or poster preference: poster

Princeton Plasma Physics Laboratory Office of Reports and Publications

Managed by
Princeton University

under contract with the
U.S. Department of Energy
(DE-AC02-09CH11466)

P.O. Box 451, Princeton, NJ 08543
Phone: 609-243-2245
Fax: 609-243-2751

E-mail: publications@pppl.gov
Website: <http://www.pppl.gov>