

Technical Specifications (In-Cash Procurement)

Maintenance of Vacuum Extension

The objective of this engineering contract is to provide the study and engineering justification for the hand-on or assisted maintenance of diagnostic vacuum extensions which are to be implemented during nuclear operation of ITER. The diagnostics with vacuum extensions have to be integrated within tokamak complex. Their ex-port plug components will be located in different places across the tokamak complex and have to be replaced, to be maintained and to withstand the operational and maintenance ...

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1 Purpose

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2 Scope

The work involves the support the ITER Diagnostic Team in definition of maintenance tasks, the study of connection/ disconnection procedures and methodology and engineering justification for the hand-on or assisted maintenance of diagnostic vacuum extensions which are located in the Equatorial Port #11, the First Plasma Port. This assessment is required for the Final Design Review of this port which is planned in 2019.

3 Definitions

CM	Configuration Model
DA	Domestic Agency
DM	Detailed Model
FDR	Final Design Review
RH	Remote Handling
IDM	ITER Document Management
IO	ITER Organization
IO-TRO	ITER Organization Technical Responsible Officer
PBS	Plant Breakdown Structure
PDR	Preliminary Design Review

For a complete list of ITER abbreviations see: [ITER Abbreviations \(ITER_D_2MU6W5\)](#).

4 References

- [1] V.S. Udintsev et al, “Final Design of the Generic Equatorial Port Plug Structure for ITER Diagnostic Systems”, [Fusion Engineering and Design](#) 2015 (to be published)
- [2] V.S. Udintsev et al, “Support structure concept for integration of ITER diagnostics in the port cell”, [Fusion Engineering and Design Volume 88, Issues 6–8](#), October 2013, Pages 1215–1218
- [3]. [ITER_D_WF8Y6D - Port Cell # 11 Maintenance Feasibility study report - FINAL - by Orano](#)
- [4]. [ITER_D_WVQTHA - 10_F-DIR_TF-17_Local_Enclosure & Contamination control guidelines](#)
- [5] ITER_D_VDM9T8 v1.1 – Neutronic Analysis of EP#11 and ITER_D_VDMBFZ v1.1 – Neutronic Analysis of EP#12

5 Estimated Duration

The duration shall be for 9 months from the starting date of the task order. Services are to be provided both at the IO work site (50%) and offsite (50%).

6 Work Description

During ITER operation, the Diagnostic Port Plug or Lower Port rack are removed from the tokamak and delivered to the Hot Cell Facility for refurbishment using the Remote Handling Equatorial Cask System. After refurbishment, Port Plug is delivered to the Port Plug Test Facility for environmental and functional tests [1]. Contrary, the Port Interspace and Port Cell equipment [2] (see Figure 1) is not maintained by the Remote Handling tools, but assisted-manual tools which imply semi-robotic and semi-hands on operations due to the activation of equipment. Once removed from the Port Cell, this equipment will be handled hands-on in a dedicated area in the Hot Cell Facility where human presence is allowed but restricted. Before removal, all vacuum extensions (tubes, transmission lines) have to be disconnected and sealed, to avoid contamination spreading, and proper local shielding has to be implemented to minimize worker's exposure to the ionising gamma radiation.

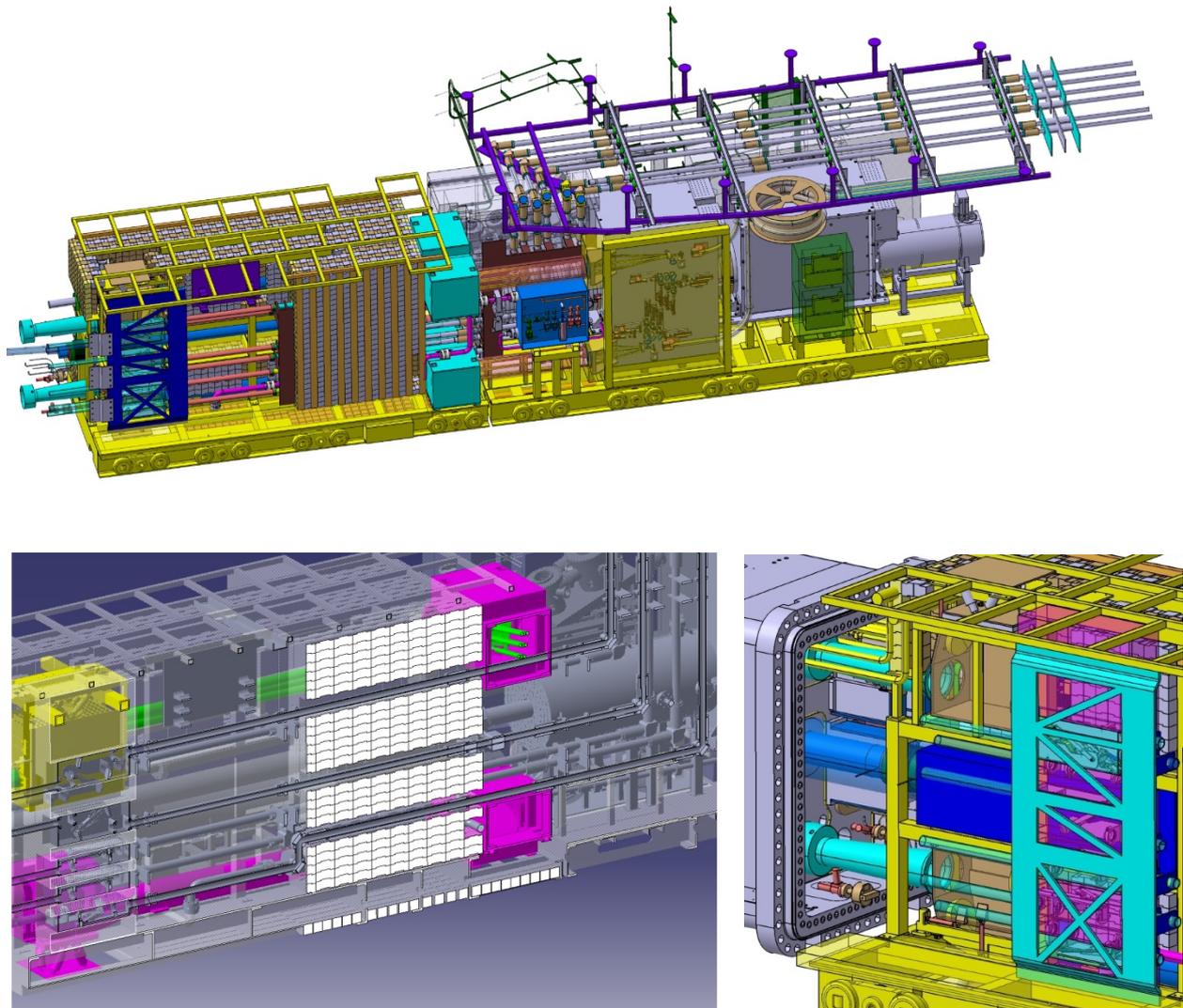


Figure 1. General layout of port interspace/ cell in Equatorial Port #11.

Following four diagnostics in Equatorial Port #11 are concerned by disconnection procedure prior to be able to remove the ISS/ PCSS in the port cell/ port interspace areas:

- 55.E3 VUV
- 55.EG XRCS
- 55.EG NPA
- 55.E3 D-VUV

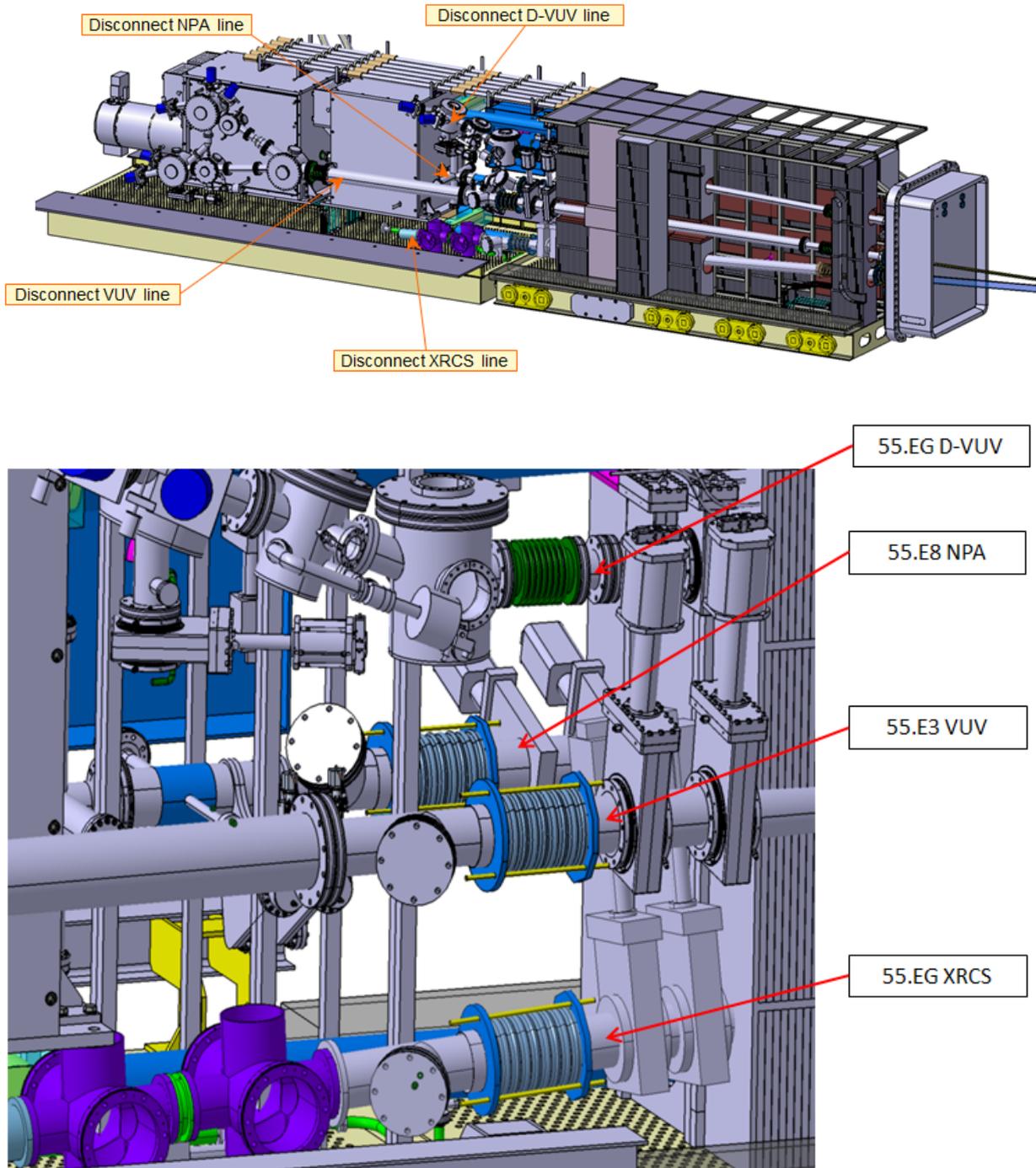


Figure 2. PCSS/ISS Layout and the four lines to be disconnected.

The following sub-tasks are foreseen:

- Develop a concept based on plastic bagging taking the experience on Vacuum group at ITER (PBS 31) as the most advanced proposal; consider that all flanges to disconnect are bolted ones. Develop procedure and define space allocation needed to perform hands-on operation.
- Justify maintenance and handling schemes by analysis for port-based diagnostics with vacuum extensions, taking into account the needs of the integrated ports plug, as well as individual systems integrated within the given ports and their specific requirements. The study shall be performed for tasks to be executed at given SDDR values, following indications from Ref. [5].
- Propose design of maintenance tools required to service diagnostic systems which would satisfy quick and reliable refurbishment of systems in-situ.
- Provide functional analysis (with constraints), set of system requirements and, if necessary, update interface sheets with detritiation system and maintenance/ RH to reflect maintenance procedures;
- Produce technical drawings of hardware involved in disconnection/ reconnection, aperture caps and local shielding;
- Follow-up and prepare (together with Port Integrating DAs) the input packages for upcoming Design Reviews of diagnostic port following Staged Approach.

7 Responsibilities

7.1 Contractor's Responsibilities

In order to successfully perform the tasks in these Technical Specifications, the Contractor shall:

- Strictly implement the IO procedures, instructions and use templates;
- Provide experienced and trained resources to perform the tasks;
- Contractor's personnel shall possess the qualifications, professional competence and experience to carry out services in accordance with IO rules and procedures;
- Contractor's personnel shall be bound by the rules and regulations governing the IO ethics, safety and security IO rules.

7.2 IO's Responsibilities

The IO shall:

- Nominate the Responsible Officer to manage the Contract;
- Organise a monthly meeting(s) on work performed;
- Provide offices at IO premises.

IO will provide the following technical inputs:

- Mechanical (integrated) models of Equatorial Port #11 and its systems;
- Relevant IO guidelines and procedures (ALARA, ORE documentation, Radiological zoning etc);
- Design description documentation for Equatorial Port #11 and its systems.

8 List of Deliverables and due dates

The deliverables are requested as follows:

D #	Description	Due Dates
D01	<p>Assess current status of maintenance of vacuum extensions in EP#11, including these from DAs. Discuss with Vacuum group (PBS 31) on the progress of handling the vacuum extensions using plastic bags. Also, collect and summarize experience from other installations where maintenance in contaminated (by beryllium and tritium) environment has been conducted, discuss with interface ROs (vacuum, diagnostic experts, maintenance, safety, neutronics expert) and put the summary report in the IDM for review and approval.</p> <p>The reviewers of the report need to be coherent with the ITER_D_2EXFXU - Sign-Off Authority for Project Documents.</p>	T0 + 1 month
D02	<p>Develop a concept based on plastic bagging taking the experience on Vacuum group at ITER (PBS 31) as the most advanced proposal; consider that all flanges to disconnect are bolted ones. Develop procedure and define space allocation needed to perform hands-on operation. Discuss them with experts and put in the IDM for review/ approval. Prepare the proper input package for the FDR.</p> <p>The reviewers of the reports need to be coherent with the ITER_D_2EXFXU - Sign-Off Authority for Project Documents.</p>	T0 + 2 months
D03	<p>Provide design of maintenance tools required to service diagnostic systems which would satisfy quick and reliable refurbishment of systems in-situ. Provide functional analysis (with constraints), set of system requirements and, if necessary, update interface sheets with detritiation system and maintenance/ RH to reflect maintenance procedures. Produce technical drawings of hardware involved in disconnection/ reconnection, aperture caps and local shielding.</p> <p>The reviewers of the reports need to be coherent with the ITER_D_2EXFXU - Sign-Off Authority for Project Documents.</p>	T0 + 4 months
D04	<p>Follow-up and prepare (together with Port Integrating DA and IO) the input packages for upcoming Final Design Review of diagnostic Equatorial Port #11.</p> <p>The reviewers of the input package need to be coherent with the Document Production Plan.</p>	T0 + 6 months

D05	<p>Amend technical design and documentation following chits and suggestions received during the Final Final Design Review of diagnostic Equatorial Port #11. Discuss them with experts and submit reports for review.</p> <p>The reviewers of the input package need to be coherent with the Document Production Plan.</p>	T0 + 9 months
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9 Acceptance Criteria

The deliverables will be posted in the Contractor's dedicated folder in IDM, and the acceptance by the IO will be recorded by their approval by the designated IO TRO. These criteria shall be the basis of acceptance by IO following the successful completion of the services. These will be in the form of reports as indicated in section 8, Table of deliverables.

10 Specific requirements and conditions

- Experience in interpretation of neutronics/ shutdown dose rate analysis;
- Experience in mechanical engineering;
- Experience in Remote Handling/ maintenance;
- Experience in application of French Nuclear Safety regulations;
- Experience in interface management;
- Schematics definition;
- Design organization;
- Technical document generation;
- System requirements management;
- Technical risk analysis.

11 Work Monitoring / Work Monitoring / Meeting Schedule

Work is monitored through reports (see List of Deliverables section).

12 Delivery time breakdown

See Section 8 "List Deliverables section and due dates".

13 Quality Assurance (QA) requirements

The organisation conducting these activities should have an ITER approved QA Program or an ISO 9001 accredited quality system.

The general requirements are detailed in [ITER Procurement Quality Requirements \(ITER_D_22MFG4\)](#).

Prior to commencement of the task, a Quality Plan must be submitted for IO approval giving evidence of the above and describing the organisation for this task; the skill of workers involved in the study; any anticipated sub-contractors; and giving details of who will be the independent checker of the activities (see [Procurement Requirements for Producing a Quality Plan \(ITER_D_22MFMW\)](#)).

Documentation developed as the result of this task shall be retained by the performer of the task or the DA organization for a minimum of 5 years and then may be discarded at the direction of the IO. The use of computer software to perform a safety basis task activity such as analysis and/or modelling, etc. shall be reviewed and approved by the IO prior to its use, in accordance with [Quality Assurance for ITER Safety Codes \(ITER_D_258LKL\)](#).

14 CAD Design Requirements (if applicable)

For the contracts where CAD design tasks are involved, the following shall apply:

The Supplier shall provide a Design Plan to be approved by the IO. Such plan shall identify all design activities and design deliverables to be provided by the Contractor as part of the contract.

The Supplier shall ensure that all designs, CAD data and drawings delivered to IO comply with the Procedure for the Usage of the ITER CAD Manual ([2F6FTX](#)), and with the Procedure for the Management of CAD Work & CAD Data (Models and Drawings [2DWU2M](#)).

The reference scheme is for the Supplier to work in a fully synchronous manner on the ITER CAD platform (see detailed information about synchronous collaboration in the ITER [GNJX6A](#) - Specification for CAD data production in ITER Contracts.). This implies the usage of the CAD software versions as indicated in CAD Manual 07 - CAD Fact Sheet ([249WUL](#)) and the connection to one of the ITER project CAD data-bases. Any deviation against this requirement shall be defined in a Design Collaboration Implementation Form (DCIF) prepared and approved by DO and included in the call-for-tender package. Any cost or labour resulting from a deviation or non-conformance of the Supplier with regards to the CAD collaboration requirement shall be incurred by the Supplier.

15 Safety requirements

ITER is a Nuclear Facility identified in France by the number-INB-174 (“Installation Nucléaire de Base”).

For Protection Important Components and in particular Safety Important Class components (SIC), the French Nuclear Regulation must be observed, in application of the Article 14 of the ITER Agreement.

In such case the Suppliers and Subcontractors must be informed that:

- The Order 7th February 2012 applies to all the components important for the protection (PIC) and the activities important for the protection (PIA).
- The compliance with the INB-order must be demonstrated in the chain of external contractors.
- In application of article II.2.5.4 of the Order 7th February 2012, contracted activities for supervision purposes are also subject to a supervision done by the Nuclear Operator.
- The list of the requirements, including defined requirements, applicable for the PBS 55 are listed in [ITER_D_28B39L - SRD-55 \(Diagnostics\) from DOORS](#) (version 5.2)

For the Protection Important Components, structures and systems of the nuclear facility, and Protection Important Activities the contractor shall ensure that a specific management system is implemented for his own activities and for the activities done by any Supplier and Subcontractor following the requirements of the Order 7th February 2012 ([PRELIMINARY ANALYSIS OF THE IMPACT OF THE INB ORDER - 7TH FEBRUARY 2012 \(AW6JSB v1.0\)](#)).