

Technical Specifications (In-Cash Procurement)

Mechanical and structural analysis for Diagnostic components_Technical Specifications

The work involves technical expertise in the design of the equipment required to physically support the diagnostics in ITER, such as port plugs, diagnostic rack, DFWs, DSMs and similar structures, and in some cases the diagnostics themselves.

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1 Purpose

This document describes technical needs for mechanical and structural analysis for ITER diagnostic components.

2 Scope

The work aligns with the ITER project, currently under construction in France. This device will study the potential of controlled nuclear fusion to provide energy for mankind. In order to study the behaviour of this device, a set of monitoring systems (referred to as Diagnostics) is required; these systems will provide the information required to understand the performance of the device. The work involves the design of the equipment required to physically support the diagnostics in ITER, e.g. diagnostic racks, port plugs and similar structures, and in some cases the diagnostics themselves. The designs have to be justified from the engineering point of view, with particular emphasis in the areas of mechanical, thermo-hydraulic and electromagnetic analysis of diagnostic port-based and in-vessel systems.

3 Definitions

CM	Configuration Model
DA	Domestic Agency
DFW	Diagnostic First Wall
DIR	Design Integration Review
DSM	Diagnostic Shield Module
DR	Diagnostic Rack
DM	Detail Model
EM	Electromagnetic
IDM	ITER Document Management
ISS	Interspace Support Structure
IO	ITER Organization
IO-TRO	ITER Organization Technical Responsible Officer
PBS	Plant Breakdown Structure
PCSS	Port Cell Support Structure
PDR	Preliminary Design Review
PP	Port Plug
RH	Remote Handling
SIR	System Integration Review
VDE	Vertical Displacement event
VV	Vacuum Vessel

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

4 References

Links inserted in text (where applicable).

5 Estimated Duration

The duration shall be for 12 months from the starting date of the contract. Services are to be provided predominantly at the IO work site. Travel to the DA or other sites may be required to carry out the work.

6 Work Description

The work involves technical expertise in the design of the equipment required to physically support the diagnostics in ITER, such as port plugs, diagnostic rack, DFWs, DSMs and similar structures, and in some cases the diagnostics themselves. The work to be done is to provide technical expertise to work with the IO-TRO. It involves many areas of activity that have to be documented:

- Meeting preparatory notes, including agenda and draft attendee selection;
- Record of progress against schedule;
- Modelization, dynamic behaviour and load characterization of diagnostic components and it support structures such as DSMs or diagnostic lower port racks;
- Thermo-mechanical analyses, structural analysis and seismic analysis of diagnostic components;
- Seismic analysis for hard core components;
- Creation of Finite Element models, load characterization, and development of handling routines to update the models and insert detailed components;
- Creation of analysis reports and Structural Integrity Reports;
- Input documents, presentations, meeting notes related to meetings related with the development of the work;
- Input documents, presentations, meeting notes related to at workshops and conferences.

Travel to the DA or other sites (including conferences) may be required to carry out the work.

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.

8 List of Deliverables and due dates

The main deliverables are provided as follows:

D #	Description	Due Dates
D01	Modelization, dynamic behaviour and load characterization, Finite Element analysis and assessment supporting the Equatorial DSM design for EP#17. Document the report in IDM.	T0 + 1 month
D02	Perform structural assessment of maintenance operation for the assembly / disassembly of diagnostic Upper PP according to PCR-439. This work shall confirm the feasibility of UPP insertion.	T0 + 2 months
D03	Review of System Load Specifications for systems located in EP#11 based on up-to-dated guidelines and load definitions. The feedback shall be given to EP11 Port Integrator and tenant systems therein to enable their progress towards PDR/FDR milestones.	T0 + 3 months
D04	Review of System Load Specifications for systems located in EP#12 based on up-to-dated guidelines and load definitions. The feedback shall be given to EP12 Port Integrator and tenant systems therein to enable their progress towards PDR/FDR milestones.	T0 + 5 months
D05	Assess and refine/ enable results data from F4E 3D VV analysis to be used for the specification of interface loads in diagnostic components (in-vessel). The aim shall be at simplification of future assessments for each individual diagnostic/ service attached to the vacuum vessel. Prepare a guideline for the specification of EM loads in diagnostic components (including data to be interpolated for the different EM transients).	T0 + 7 months
D06	Electromagnetic and associated mechanical analysis of asymmetric/ bar rotating VDEs. Upload analysis reports in the IDM.	T0 + 9 months

D07	Assess the System Load Specifications for systems located in EP#17 based on up-to-dated guidelines and load definitions. The feedback shall be given to tenant systems therein to enable their progress towards PDR/FDR milestones.	T0 + 10 months
D08	Production of engineering justification by analysis (mechanical, thermal, electromagnetic) for the PDR of EP#17. Review the technical reports. Management of the load specification and structural integrity analysis of EP#17 including fire loads in the Port Cell and loads on the Hard Core Components.	T0 + 12 months

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 thermo-mechanical and seismic analysis;
- Experience in FEA codes (e.g. ANSYS, CFX)
- Experience in application of appropriate industrial Codes and Standards of nuclear/non-nuclear equipment (e.g. ASME VIII Div 2, ASME III, RCC-MR);
- Experience in 3D and 2D drawings interpretation;
- Experience of all techniques in deliverables list;
- Schematics definition;
- Design organization;
- Technical document generation;
- System requirements management;
- Technical risk analysis.

11 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.

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 \(AW6JSB v1.0\)](#)).