

Mechanical, Thermo-Hydraulic and Electromagnetic Analysis of ITER Diagnostics Components

Technical Specifications

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	<i>Name</i>	<i>Affiliation</i>
<i>Author</i>	V. UDINTSEV	DIAGNOSTICS
<i>Reviewers</i>	M. WALSH	DIAGNOSTICS
<i>Approver</i>	P. THOMAS	CHD

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1 Abstract

This document describes the specific technical needs of the Diagnostics Division with particular reference to Design Engineering Work, predominantly in the following areas:

- mechanical
- thermo-hydraulics
- electromagnetics

2 Background and Objectives

ITER is a major new device that is under construction at Cadarache, 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 described below is related to the design of the equipment required to physically support the diagnostics in ITER, e.g. port plugs and similar structures, and in some cases the diagnostics themselves.

3 Scope of Work

The objective of this engineering contract is primarily to support the ITER Diagnostic Team in the analysis that supports the diagnostic design, with particular emphasis in the areas of mechanical, thermo-hydraulic and electromagnetic analysis.

4 Estimated Duration

The duration shall be for 440 working days over 2 years from the starting date of the contract. The work base will be at the home institution/office of the contractor for the majority of the time.

Occasional visits to the ITER working site, anticipated at up to 4 times per annum, as determined by the ITER Responsible Officer (RO), will be required.

5 Work Description

- Perform, collate and check the analytical and numerical calculations supporting diagnostic design in the area of mechanical, thermo-hydraulics and electromagnetics.
- Suggesting mechanical and thermo-hydraulic design of diagnostic components.
- Application and checking of appropriate codes and standards against diagnostic designs, examples of such codes would be such like RCC-MR and ASME codes.
- Perform 3D numerical thermal, electromagnetic (EM) and structural analysis of various diagnostic components.

- Perform stress analysis at specified load combinations, which are required for the Conceptual (or other) Design Review of the components, in order to obtain stresses, strains and displacements in all specified structural parts of the components. The ultimate goal of this analysis is to demonstrate the feasibility of the design solution concept and if not feasible, optimize the existing one or propose a suitable new design.
- Perform the evaluation of static strength of the parts in accordance with the specified design criteria (examples such as SDC-IC or ASME VIII, div.2, RCC-MR, etc).
- Provide appropriate Structural Analysis, Technical Analysis and Structural Integrity Reports in a suitable format as per IO templates.
- Assist Diagnostic Division in writing technical and manufacturing specifications for diagnostics and integrated systems to advance towards manufacturing.
- Support the Diagnostic Division, as appropriate, to fulfil its mission in the design engineering and analysis area.

6 Responsibilities (including customs and other logistics)

When applicable.

7 List of deliverables and due dates (proposed or required by ITER)

Deliverable	Dates
Progress report	Every month after starting date
Final report	At the end of the contract

8 Acceptance Criteria (including rules and criteria)

This criteria shall be the basis of acceptance by IO following the successful completion of the services. These will be in the form of monthly progress reports as indicated in section 6, table of deliverables and further detailed below:

Report and Document Review criteria.

Reports as deliverables shall be stored in the ITER Organization’s document management system, IDM by the Contractor for acceptance. A named ITER Organization’s Contract Technical Responsible Officer is the Approver of the delivered documents.

The Approver can name one or more Reviewers(s) in the area of the report’s expertise.

The Reviewer(s) can ask modifications to the report in which case the Contractor must submit a new version.

The acceptance of the document by the Approver is the acceptance criterion.

9 Specific requirements and conditions

Person(s) to carry out the work described in this document must have proven experience, as appropriate.

Particular Skills and competencies

- Proven experience with vacuum systems (at least 5 years);
- Proven experience in working with CAD designers (at least 5 years);
- Proven experience in prototyping and manufacturing (at least 5 years);
- Proven experience in NDT methods and techniques (at least 5 years);
- Proven experience in Project Management (at least 5 years).

General

- ability to work with partners and host to define optimum/critical needs for ITER
- ability to work with ITER processes to achieve optimum results
- ability to align work priorities with overall project schedule
- excellent technical writing skills
- excellent communication and influencing skills
- excellent attention to detail
- excellent inter-personal skills
- work well under pressure
- ability to work in team environment
- ability to interface with global partners
- appropriate ability to comprehend technical issues and ensure addressed by others

10 Work Monitoring / Meeting Schedule

Meetings and progress reports

The work will be managed by means of Progress Meetings and/or formal exchange of documents transmitted by emails which provide detailed progress. Progress Meetings will be called by the ITER Organization, to review the progress of the work, the technical problems, the interfaces and the planning.

The main purpose of the Progress Meetings is to allow the ITER Organization/Diagnostics Division and the Contractor Technical Responsible Officers to:

- a) Allow early detection and correction of issues that may cause delays;
- b) Review the completed and planned activities and asses the progress made;
- c) Permit fast and consensual resolution of unexpected problems;
- d) Clarify doubts and prevent misinterpretations of the specifications.

In addition to the Progress Meetings, if necessary, the ITER Organization and/or the Contractor may request additional meetings to address specific issues to be resolved.

For all Progress Meetings, a document describing tasks done, results obtained, blocking points must be written by the engineer. Each report will be stored in the ITER IDM in order to ensure traceability of the work performed.

Every 3 months, the Contractor shall submit to ITER Organization a Progress Report to be issued five working days before the each Progress Meeting so that the report can be reviewed prior to, and discussed at, that Meeting.

The quarterly Progress Report shall illustrate the progress against the baseline work plan and indicate variances that should be used for trending. Performance indicators suitable to measure the progress of the work as compared to the approved work plan shall also be reported in the Monthly Progress Report.

11 Payment schedule / Cost and delivery time breakdown

Interim payments will be made monthly upon production of a monthly report and completed time sheet in line with the table of deliverables in section 7. Payments will only be processed upon IO approval of the reports and against receipt of a valid invoice.

12 Quality Assurance (QA) requirement

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 document [ITER Procurement Quality Requirements \(22MFG4\)](#)

Prior to commencement of the task, a Quality Plan [Quality Plan \(22MFMW\)](#) 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.

Prior to commencement of any manufacturing, a Manufacturing & Inspection Plan [Manufacturing and Inspection Plan \(22MDZD\)](#) must be approved by ITER who will mark up any planned interventions.

Deviations and Non-conformities will follow the procedure detailed in IO document [MQP Deviations and Non Conformities \(22F53X\)](#)

Prior to delivery of any manufactured items to the IO Site, a Release Note must be signed [MQP Contractors Release Note \(22F52F\)](#).

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, it should fulfil IO document on Quality Assurance for ITER Safety Codes [Quality Assurance for ITER Safety Codes \(258LKL\)](#).

13 References / Terminology and Acronyms