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Technical Specifications

For

Vessel and port mounted component-scoping design

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1 Purpose

This document describes technical needs of ITER Diagnostics Division, with particular reference to the requirement for engineering of vessel and cryostat mounted components.

2 Background and Objectives

ITER is a major new device that is under construction at Cadarache, near Marseille, France. This device will study the potential of controlled nuclear fusion to provide energy for mankind. To study the behaviour of this device, a set of monitoring systems (called Diagnostics) are required. These systems will provide the information required to understand and control the performance of the device. In particular, a large number of front-end components are used that are in need of engineering support to define their detailed design.

3 Scope of Work

The scope of this work is (1) to prepare design options for each of the components. (2) To perform basic analyses to establish feasibility of the in-vessel component design (3) to draft specification and oversee detailed analysis and concurrent CAD developments

4 Definitions

For a complete list of ITER abbreviations see: ITER Abbreviations (ITER_D_2MU6W5).

5 References

N/A

6 Estimated Duration

The duration is estimated to be 12 calendar months from the start of the contract.

7 Work Description

The bidder will prepare work in the following areas:

A. Develop design options for the following components
    1. Bolometer platforms mounted on the vacuum vessel
    2. Saddle loop tooling and attachments under the triangular support
    3. Combined vacuum extension tubes on port 11 (incl. bellows & support)
    4. ECH sensor boxes behind the blanket
    5. Upper port loom elements, comprising:
        i. ECH upper port top looms: design and preliminary analysis. These looms house a maximum of 36 D4 MI cables. Vertical space reservation is 10mm, width is 140mm. High nuclear loads in the first 40cm (~0.55W/cc) in port then very low (0.05W/cc). No ECH and ICH loads are foreseen. Boss design.
        ii. Generic upper port top looms: design and preliminary analysis. These looms house a maximum of 36 D4 MI cables. Vertical space reservation is 20mm, width is 70mm. High nuclear loads in the first 40cm (~0.55W/cc) in port then very low (0.05W/cc). No ECH and ICH loads are foreseen. Boss design.

iii. Generic upper port bottom looms: : design and preliminary analysis. These looms house a maximum of 24 (25) D4 MI cables. Vertical space reservation is 16mm, width is 65mm (space might be increased to 20*70). Elevated nuclear loads in the first 40cm (~0.12W/cc) in port then very low (0.05W/cc). No ECH and ICH loads are foreseen. Boss design.
iv. Unified upper port bottom looms: design and preliminary analysis. (Background: looms must be unified so that feedthroughs can be eliminated). These looms house a maximum of 54 D4 MI cables. Vertical space reservation is 16mm, width is 65mm (but space can and must be increased to 28*70). Elevated nuclear loads in the first 40cm (~0.12W/cc) in port then very low (0.05W/cc). No ECH and ICH loads are foreseen. Boss design.
v. OB loom entry into upper port bottom area: These looms house a maximum of 24 (25) D4 MI cables. Vertical space reservation is 16mm, width is 65mm. Longitudinal radius is 120mm. Space might have to be shared with microfission chamber cables. Nuclear loads (~0.12W/cc). Both ECH (3kw/m2 with Cu coating) and ICH are possible. Boss design.

6. Lower port loom elements, comprising:
   i. Divertor looms in torus: design and preliminary analysis. These looms house a combination of D4 and D7 cables. No ECH and ICH loads are foreseen.
   ii. LP looms entry into port: design and preliminary analysis. Applicable to all loom types (V0, D0). VV radius 30mm. Nuclear loads low (~0.025W/cc). No ECH and ICH loads are foreseen.
   iii. V0 looms in lower port, first 1m: design and preliminary analysis. These looms house a maximum of 144 D4 MI cables. Vertical space reservation is 10mm, width is 400mm. Nuclear loads is ~0.025W/cc. No ECH and ICH loads are foreseen.
   iv. D0 looms in lower port, first 1m: design and preliminary analysis. These looms house a maximum of 71 D4 and 20 D7 MI cables. Vertical space reservation is 25mm, width is 148mm. Nuclear loads is ~0.025W/cc. No ECH and ICH loads are foreseen.
   v. D0 looms in lower port, deeper in port: design and preliminary analysis. These looms house a maximum of 71 D4 and 20 D7 MI cables. Vertical space reservation is 10mm, width is 500mm. Nuclear loads is less than~0.015W/cc. No ECH and ICH loads are foreseen.
   vi. D0+V0 looms in lower port, deeper in port: design and preliminary analysis. These looms house a maximum of 215 (71+144) D4 and 20 D7 MI cables. Vertical space reservation is 20mm, width is 500mm. Nuclear loads is less than~0.015W/cc. No ECH and ICH loads are foreseen.

B. Assess, by simple analysis, the performance of these components against loads (EM, thermal, assembly as appropriate)

Prepare of supporting documents and draft presentations for design reviews (PDRs) can be appended to work delivered under B, above. By mutual agreement, other equivalent components can be analyzed.

The engineering disciplines required are in order of importance: Mechanical and Structural design, Thermal Analysis and Electromagnetic force analysis. Experience with design work for nuclear or vacuum environment is essential.

There is a requirement to liaise with IO Responsible Officer over the period of the contract, who will be working on other aspects of the system.

8 Responsibilities

8.1 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.
- The Contractor shall execute the work under section 6 with the deliverables of Section 8.
- One person shall be the designated contact point for IO staff for the duration of the contract.
- The Contractor shall upload all documents to ITER databases as appropriate.

8.2 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.
- Support the work by providing appropriate access to databases, standards and persons.

9 List of deliverables and due dates

Number	Deliverable	Dates*
A01	Bolometer platforms design options	T0 + 1m
A02	Upper port loom elements design options	T0 + 3m
A06	Saddle loop tooling design options	T0 + 4m
A05	Lower port loom elements design options	T0 + 6m
B01	Bolometer platforms design assessment	T0 + 7m
B02	Upper port loom elements design assessment	T0 + 9m
B06	Saddle loop tooling design assessment	T0 + 10m
B05	Lower port loom elements design assessment	T0 + 12m
* T0 – date when contract signed by both parties The order of delivery can be varied by mutual agreement to suit the needs of the project.		

10 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 9, Table of deliverables

11 Specific requirements and conditions

The profile/CVs required to carry out the work described in this document shall have proven experience as appropriate, and ideally have the following skills and competencies:

Particular Skills and competencies
- Proven experience in the design of in-vessel systems (at least 5 years);
- At least 10 years' experience of engineering in a large Tokamak or Stellarator;
- Proven experience in working with CAD designers (at least 5 years);
- Engineering degree or equivalent professional qualification;
- Experience of structural design under large EM loads.

General
Role description: Technical Programme Expert

- 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
- work well under pressure
- ability to work in team environment
- appropriate ability to comprehend technical issues and ensure addressed by others

12 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.

13 Payment schedule / Cost and delivery time breakdown

Payments will be made by IO upon completion and acceptance of the deliverables in accordance with the table of deliverables in section 9. Payments will only be processed upon IO approval of the reports and against receipt of a valid invoice.

14 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).