Engineering support in IC antenna design, thermal and hydraulic analysis

Contract Technical Specifications

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1 Abstract

This document describes technical needs of the IC & LH section, with particular reference to Design Engineering work, thermal, hydraulic and thermo mechanical analysis on the Ion Cyclotron Heating and Current Drive (IC H&CD) system and its components. These needs include both design and follow up activities, as appropriate.

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 reach the target performances of this device, a set of plasma heating systems are required. These systems will deliver power to the plasma to sustain and control the performance of the device.

The work described below is related to the hardware required to physically transmit radio-frequency power into ITER, and is more specifically focused on the coupling structure, called an Ion Cyclotron Heating and Current Drive (IC H&CD) antenna, and illustrated Figure 1. The scope of work will also cover thermal and thermo-mechanical aspects of other parts of the IC H&CD system, as needed (for instance, the RF matching systems shown Figure 2).

Fig.1 - Equatorial Port Plug Antenna for IC H&CD power coupling to plasma: 3.5 x 2.5 x 1.9m, 45 tons
3 Scope of Work

The scope of this contract includes the supply of specialised services to perform the following activities:

- Support the IC H&CD team in the design of the IC antenna, with emphasis on the hydraulic, thermal and thermo-mechanical aspects.
- Support the IC H&CD team in the follow-up and assessment of the progress of the externally contracted design activities.
- Contribute to the detailed development of the IC antenna interfaces with other ITER components, with emphasis on the hydraulic, thermal and thermo-mechanical aspects.
- Perform thermal, hydraulic and thermo-mechanical analysis on the proposed design to verify its compliance with ITER requirements.
- Some interactions with other ITER teams and participations to meetings will be part of the task.
- Write technical specifications covering forthcoming design activities.
- As the final design will approach completion, the work will involve a strong contribution to the preparation of the technical specifications for a call for tender for the fabrication of the antenna. This will include overseeing the production of tendering drawings.
- Report activities progress to section leader and interact with IC team.
4 Estimated Duration

The total duration of this contract shall be up to 2 years from its formal signature date.

5 Work Description

Description of the tasks to perform:

- Prepare appropriate design outputs in key areas such as outlined in the above Scope of Work.
- Review technical designs, created by others, and agree/implement required changes, in collaboration with the relevant ITER staff.
- Draft and report the performed work in the required format, primarily in the form of design notes, analysis and structural integrity reports.
- Provide analytical and additional appropriate assessment with the aim of justifying the feasibility of the proposed designs, including assessment of manufacturability and inspectability.
- Carry out additional design work as may arise during the course of the contract.
- Write technical specifications for design activities.
- Near completion of the final design, contribute to the preparation of technical specifications for a call for tender for the fabrication of the antenna.
- Promote safety and quality at all times in all job activities.

6 Responsibilities (including customs and other logistics)

Not applicable.
7 List of deliverables and due dates (proposed or required by ITER)

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<th>Milestone No:</th>
<th>Deliverables</th>
<th>Due date of the last deliverable</th>
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<td>1</td>
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<tr>
<td>12</td>
<td>12th Intermediate report &amp; Report on first year</td>
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<td>24</td>
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8 Acceptance Criteria (including rules and criteria)

The selection will be done taking into account the following criteria and an interview:
1) Expert CV 70%
2) Price 30%
9 Specific requirements and conditions

The successful candidate Expert shall hold a Masters Degree in Engineering or equivalent, and must have proven experience in several of the following items:

- Minimum 5 years experience in Structural Design
- Experience in Nuclear Fission/Fusion is an advantage
- Experience of working with CAD Designers
- Experience in mechanical fabrication of large components
- Expertise in performing numerical engineering analysis
- Ability to balance quality/risk/cost when providing design information.
- Ability to work in multidisciplinary, international team environment.
- Knowledge of Quality Assurance systems and their practical application (1984 Quality Order),
- Knowledge of ANSYS for mechanical design checking
- Conversant with the RCC-MR Design Code.
- Must be fluent in the English language, both written and oral.

10 Work Monitoring / Meeting Schedule

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. These meetings will also be used to define or revise the work plan of the following month(s).

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 assess 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.

Every month, the Contractor shall submit to ITER Organization a Progress Report to be issued five working days before each Progress Meeting so that the report can be reviewed prior to, and discussed at, that Meeting. Each report will be stored in the ITER IDM in order to ensure traceability of the work performed.

The Monthly Progress Report shall illustrate the progress against the monthly 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:

- *Interim payments may be processed monthly subject to IO approval of progress reports in accordance with the scope of work defined in the present technical specification, ITER_D_46D4XB.*

- *Payments will be made upon IO approval of the corresponding monthly progress report, and upon submission & IO approval of a valid time sheet and correctly rendered invoice.*
12 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 document [ITER Procurement Quality Requirements (22MFG4)].

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