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Expert Engineer
to provide coordination and support
for mechanical design and structural analysis
within the IC&LH Section

Technical Specification

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Table of Contents

1 Abstract

This document describes technical needs of the **Ion Cyclotron & Lower Hybrid Section in the fields of Engineering Design, Design Evaluation and Design Coordination.**

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 launch radio-frequency power into the ITER plasmas, 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 mechanical aspects of other parts of the whole IC H&CD system, as needed (for instance, the RF matching systems shown Figure 2).

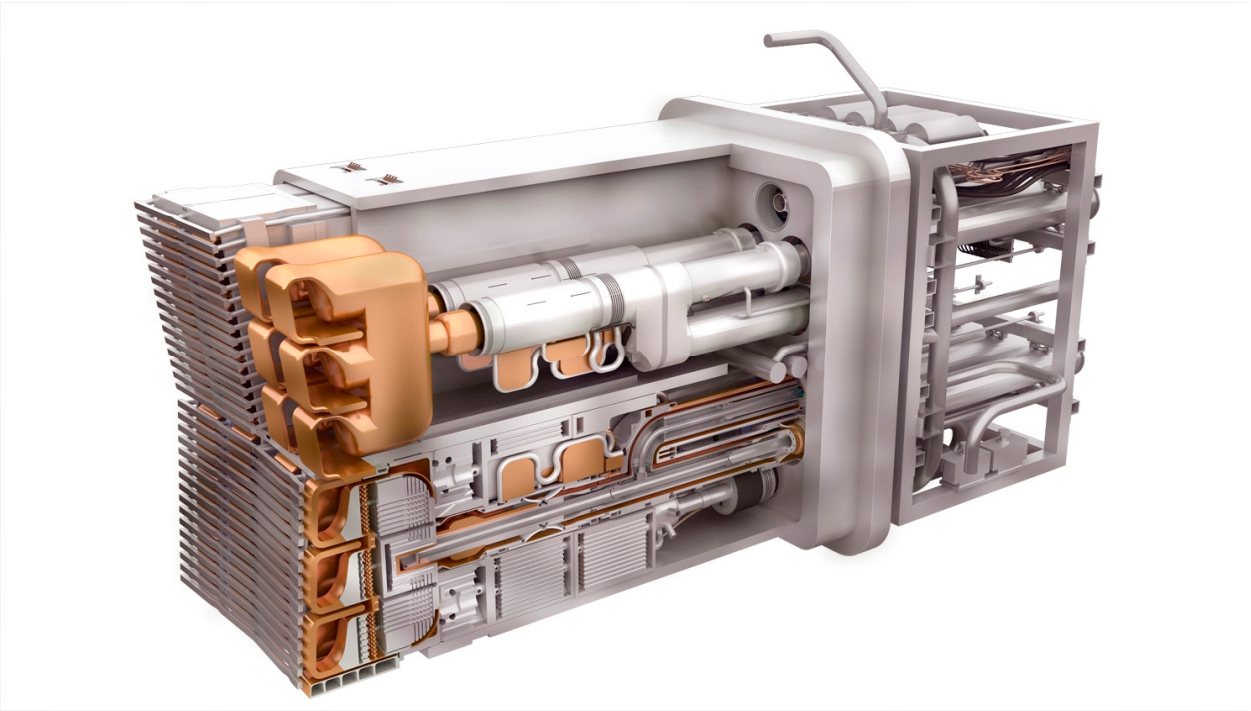

Fig.1 - Equatorial Port Plug Antenna for IC H&CD power coupling to plasma: 3.5 x 2.5 x1.9m, 45 tons

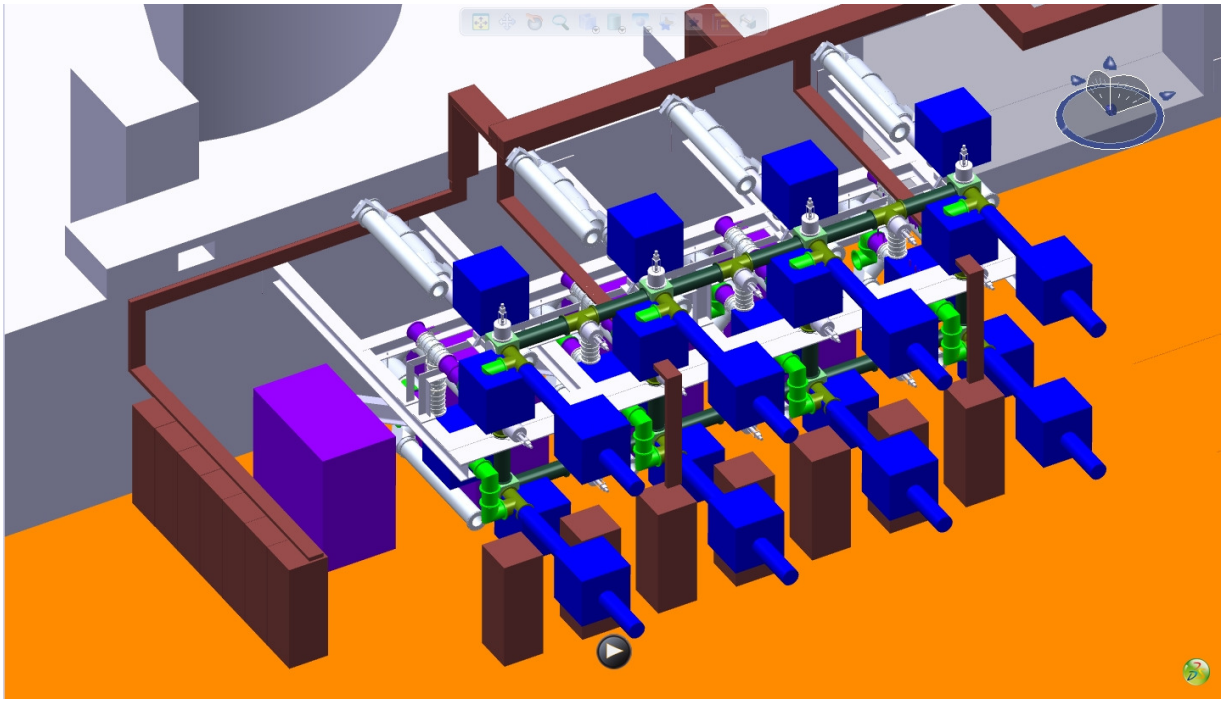

Fig.2 - IC H&CD matching units in Assembly hall: foot print is approximately 11m x 13m.

3 Scope of Work

The primary objective of this engineering contract is to support the IC&LH Section in the **mechanical design, and in the structural and thermo mechanical assessment** of key components. The design of the antenna will need to be assessed first at preliminary design level, then it will need to be brought to final design level.
Depending on the location of components, various loads will need consideration - thermal, electromagnetic and seismic. All the interfaces will be considered, such as, but not limited to, the following areas: piping, electrical, radiofrequency, vacuum related to antenna and transmission line key components.

As mentioned in the Abstract, the scope of work includes Engineering Design, Design Evaluation and Design Coordination. The sharing between these different types of activities shall be adjusted to the needs of the Section all along the duration of the contract.

- During the whole contract the coordination work will involve the writing of technical specifications and the follow up of contracts covering (but not limited to) remote handling, neutronics, manufacturability and maintainability analysis, as well as the following likely tasks:
    - contribution to the preparation of data for CAD exchange to provide data to external companies,
    - control and integration of the design of equipment (or parts of equipment) performed by external companies,
    - assessment of structural and other design reports and, as needed, independent mechanical design verification with ANSYS.

- During the assessment at preliminary design level, the work will consist in
  - Studying reports delivered by external design teams
  - Verifying design compliance with the ITER requirements and with the IC H&CD system requirements.
  - Checking conformity regarding interfaces (between components of the IC H&CD and with other ITER systems), and codes and standards.
- During the final design phase, the work will consist in the coordination of different actions to finalize the design:
  - Integration of R&D results in the antenna design and in its CAD model;
  - Management of any resulting interface modification
  - Remote handling, neutronic, manufacturability, inspectability and maintainability analysis.
- As the final design will approach completion, the work will focus on the preparation of the technical specifications for a call for tender for the fabrication of the antenna.

- Any additional mechanical design work as may be needed during the execution of the contract.

It is anticipated that the contracting body will second an ITER expert to perform the work described in the present Scope and in Section 5 below. The expert will interact with and report to the IC&LH section, which is assisted by a CAD designer.

Besides outstanding technical competencies, an excellent knowledge of English, including a proficient level of written English, is essential.

4 Estimated Duration

The duration of the contract is for up to 24 months from its starting date.
The work will be performed mainly at the ITER IO Worksite, with some off-site work possible.

5 Work Description

Description of the tasks to perform:

- Contribute to the design, to the design assessment and to the design coordination in key areas such as outlined in the above Scope of Work.

- Review technical designs, created by others, and agreeing/implementing required changes, in collaboration with ITER staff.

- Draft and report the performed work in the required format; for instance in the form of 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.
- Promote safety and quality at all times in all job activities.

6 General reporting and due dates

Subtask	Deliverable	Dates
1	Initial progress report	One month after starting date
2	Progress reports	Every two months thereafter
3	Final report	At end of contract period

7 Acceptance Criteria (including rules and criteria)

The selection will be done taking into account the following criteria:

1) Expert's CV 40%
2) Expert's Interview 30%
2) Cost 30%

8 Specific requirements and conditions

The successful candidate Expert shall be graduated of a Master Degree in Mechanical 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**.

9 Work Monitoring / Meeting Schedule

The seconded expert will integrate the IC&LH Section. The work will be managed by means of Progress Meetings and/or formal exchange of documents providing 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. It is expected that Progress Meeting will be held as frequently as required, generally weekly.

The main purpose of the Progress Meetings is to allow the ITER Organization/IC&LH section and the seconded Expert to:

a. Early detect and correct any issue that might 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 any doubts and prevent misinterpretations of the specifications.

The reports will be stored in the ITER IDM system in order to ensure traceability of the work performed.

After the first monthly report, every 2 months, the Contractor shall submit to ITER Organization a Progress Report.

10 Payment schedule / Cost and delivery time breakdown

Payments shall be made after submission of reports and their acceptance by the ITER Organization.

11 Quality Assurance (QA) requirements

The organisation conducting these activities shall 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 Management and 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.
Deviations and Non-conformities will follow the procedure detailed in IO document MQP Deviations and Non Conformities (22F53X) .
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).

12 Terminology and Acronyms

IC	Ion Cyclotron
LH	Lower Hybrid
H&CD	Heating and Current Drive

IO	ITER Organization
RF	Radio-frequency
DA	Domestic Agency
CAD	Computer Aided Design
HCD	Heating and Current Drive
CHD	CODAC, Heating and Diagnostics
IDM	IO Document Management