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

Technical Specification

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1 Abstract

This document describes technical needs of the **Ion Cyclotron & Lower Hybrid Section in the fields of Engineering Design, Nuclear Safety qualification of components, Codes and Standards, 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).

ITER is an Installation Nucléaire de Base under French law, and its components having a nuclear safety function must be designed, qualified, procured, inspected and operated in compliance with the relevant nuclear regulatory framework.

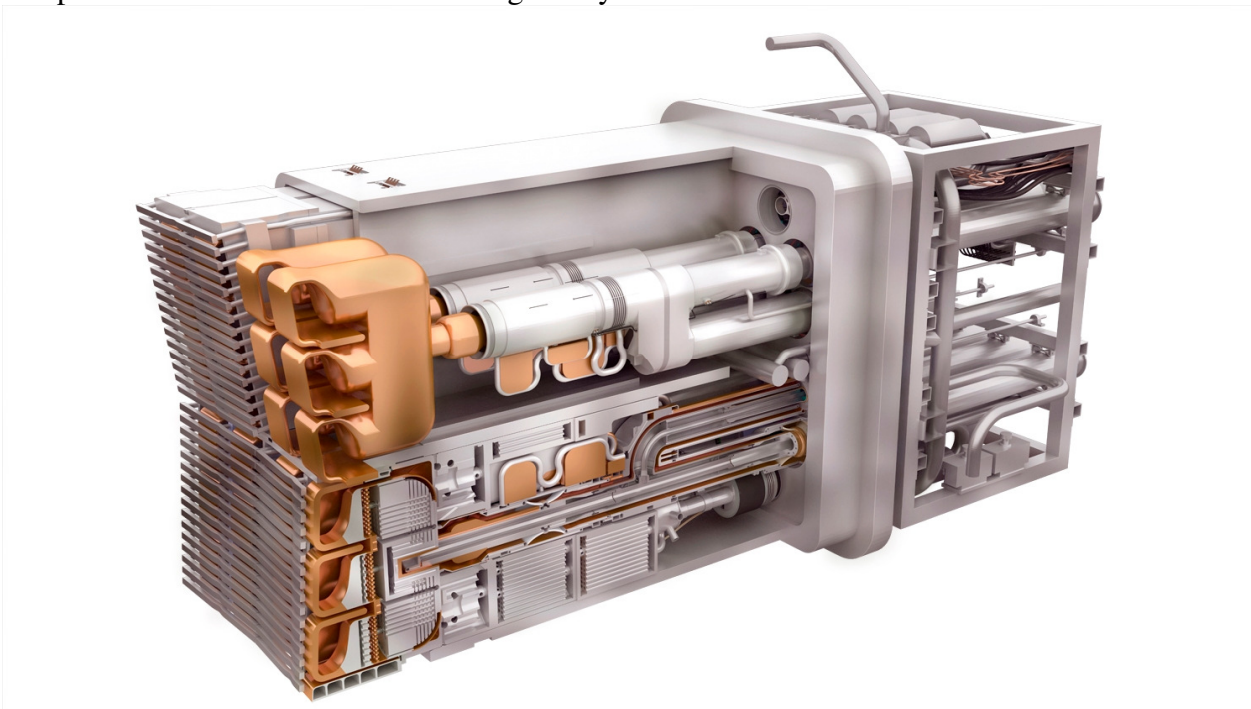

Fig.1 - Equatorial Port Plug Antenna for IC H&CD power coupling to plasma: 3.5 x 2.5 x1.9m, 45 tons

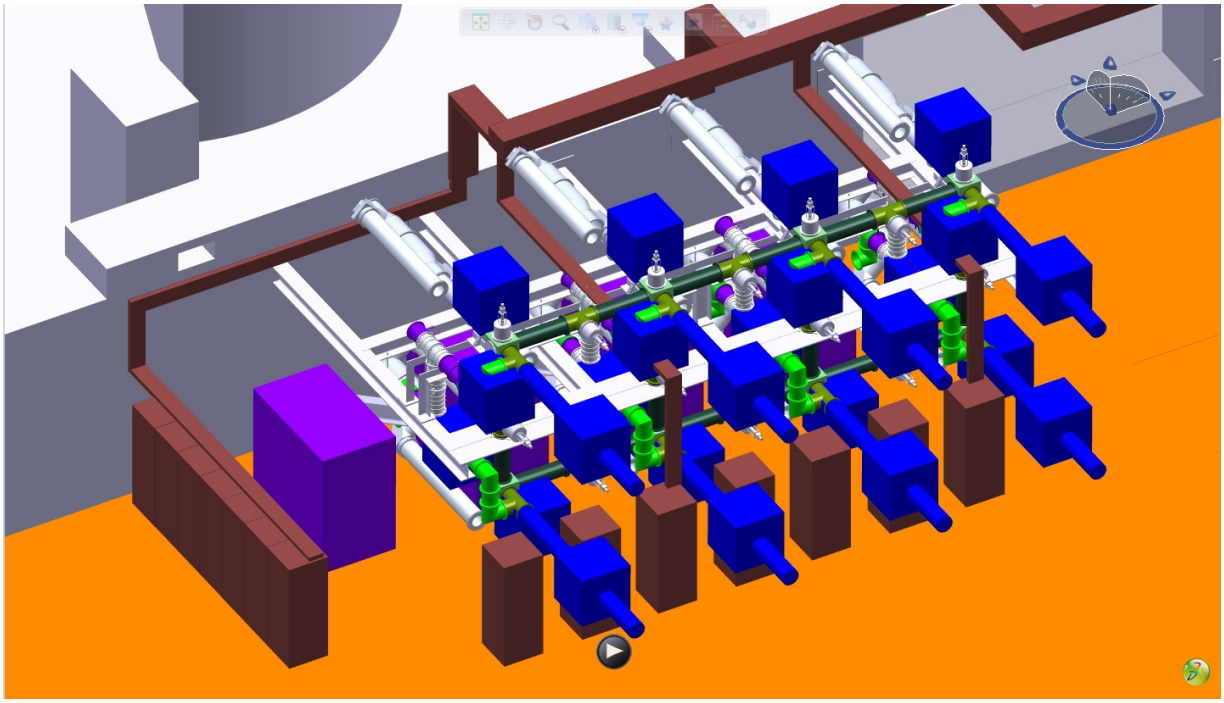

Fig.2 - IC H&CD matching units in Assembly hall: foot print is approximately 11m x 13m.

3 Scope of Work

The primary objective of this engineering contract is to support the IC&LH Section in the **mechanical design of key components, and in the qualification of components having a safety function to adequate nuclear codes and standards.** The design of the antenna needs to be brought from the preliminary to the final design level.
Depending on the location of components, various loads require 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.

The sharing between the different types of activities shall be adjusted to the needs of the IC&LH 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.
- The assessment of work externally contracted by IO will consist in

- Studying reports
- 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.

- 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 expert to ITER 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 assessments 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	Monthly
3	Final report	At end of contract period

7 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.

8 Specific requirements and conditions

The successful candidate Expert shall hold a Masters 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
- Experience with nuclear codes and standards, familiar with the RCC-MRx 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 documentation management system (IDM) in order to ensure traceability of the work performed.

The Contractor shall submit to ITER Organization a Monthly Progress Report.

10 Payment schedule / Cost and delivery time breakdown

Interim monthly payment, after submission and acceptance of the Monthly Progress Report with supporting documents to 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