

Technical Specifications (In-Cash Procurement)

**Technical Specification for ITER HCD Mechanical
Analysist**

Details the technical requirements for a mechanical analysist in the ITER HCD division.

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1 Purpose

This document describes technical needs of for specialist work relating to the mechanical engineering analysis, mechanical design, design and evaluation and the writing of technical specifications for the design and evaluation work required for the ICH Antenna project.

2 Scope

The work comprises of the evaluation, verification and compliance of the mechanical designs of the ICH antenna produced by the ICH Antenna design team as well as the writing of technical specifications. The Ion Cyclotron Heating (ICH) antenna uses radio frequency (RF) in the range of 40 to 55MHz to provide the heating and current drive to the ITER plasmas in order to assist in accessing the H-mode and achieving $Q=10$ as well as other plasma control functions.

The design of the antenna is being outsourced to a consortium (consisting of a number of European laboratories) called CYCLE and work is required at ITER to verify and check that the design conforms to all the necessary ITER requirements.

The work will support the ITER ICH antenna project manager in moving the antenna design from PDR through to FDR and providing all the necessary detailed technical specifications and drawings for the procurement.

3 Definitions

DA: Domestic Agency

EPP: Equatorial Port Plug

ICH: Ion Cyclotron Heating

IO: ITER Organization

IO-TRO: ITER Organization Technical Responsible Officer

ISS: Interspace Support Structure

P&ID: Piping and Instrumentation Diagrams

PCSS: Port Cell Support Structure

SLD: Single Line Diagram

TL: Transmission Line

PDR: Provisional Design Review

FDR: Final Design Review

For a complete list of ITER abbreviations see: [ITER Abbreviations \(ITER_D_2MU6W5\)](#).

4 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 services described below are required for the hardware under development to launch radio-frequency power into the ITER plasmas, and are more specifically focused on the coupling structure, called an Ion Cyclotron Heating and Current Drive (IC H&CD) antenna, illustrated in 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 transmission lines and the RF matching systems shown Figures 2 and 3).

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.

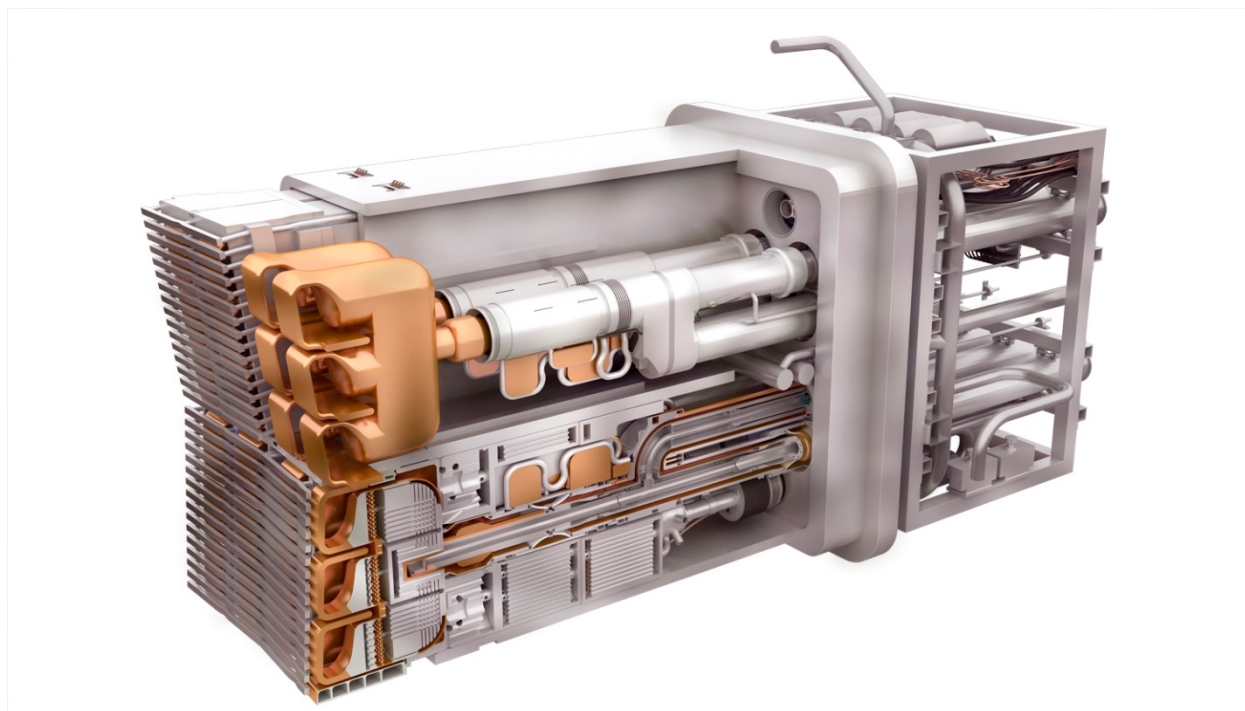


Fig.1 - Equatorial Port Plug Antenna for IC H&CD power coupling to plasma: 3.5 x 2.5 x 1.9m, 45 tons

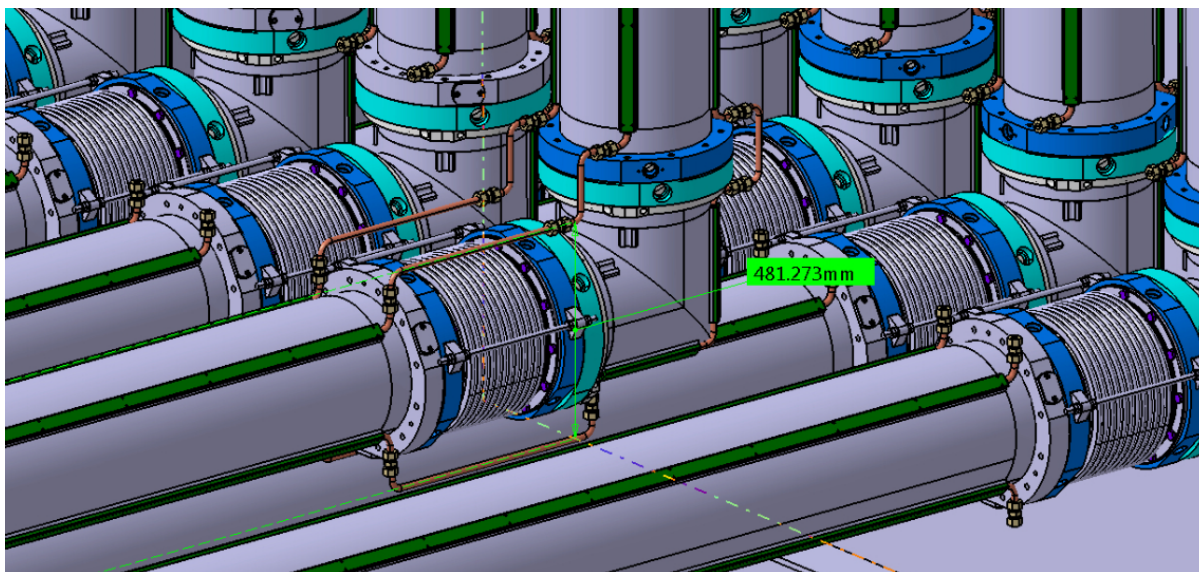


Fig.2 - Sections of IC H&CD actively cooled RF transmission lines, showing assembly bellows.

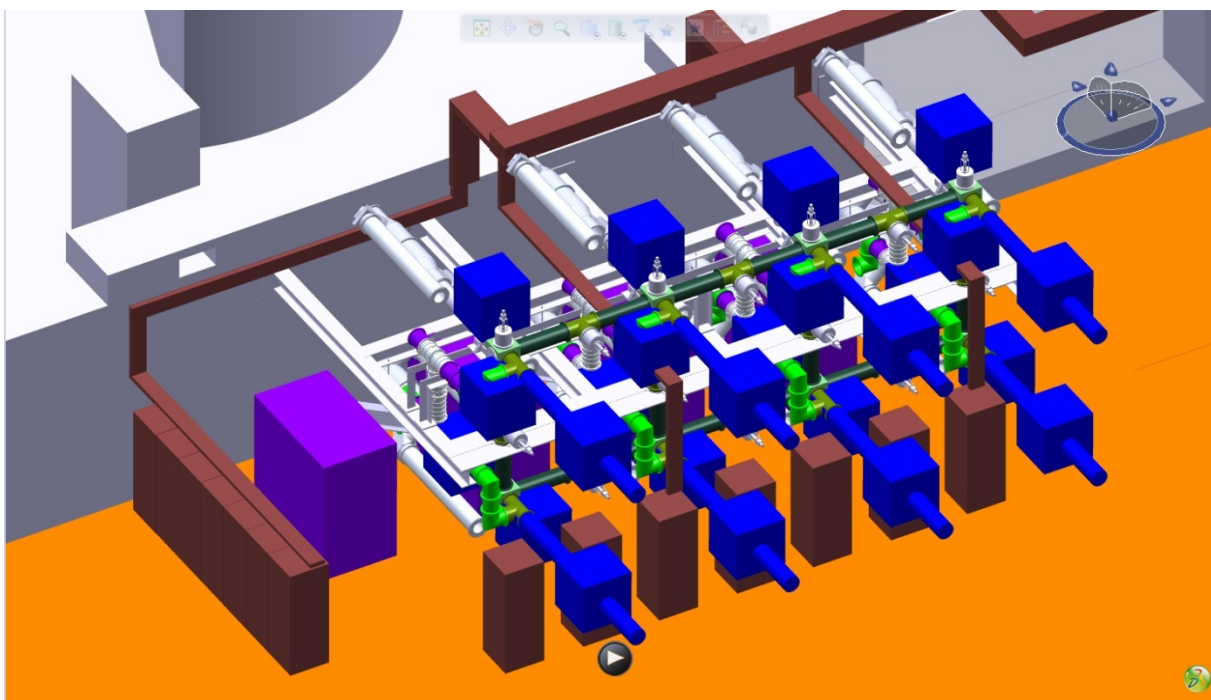


Fig.3 - IC H&CD matching units in Assembly hall: foot print is approximately 11m x 13m.

5 Duration

The duration shall be for 12 months (full time) from the starting date, defined by the kick-off meeting. Full services will be provided at the ITER IO Worksite. However, if the contractor wishes to complete some of the work at their own worksite for some period then it is expected that the minimum services which are to be provided at the ITER IO Worksite will be for at least 2 weeks per month.

6 Work Description

The work involves technical contribution in the following areas:

- Design and engineering justification of mechanical equipment implemented in the ICH antenna design
- Effective management of deliverables and associated work to IO-TRO to meet project schedule in relevant areas of ICH antenna design.
- Preparation of technical specifications for load case assessment for the ICH Antenna.
- Preparation of technical reports, analysis and CAD models;
- Preparation of meeting notes, including agenda and draft attendee selection;
- Meeting notes for IO meetings called by interfacing systems and review bodies;
- Draft minutes for IO and DA meetings;
- Preparation of input documents, presentations, meeting notes related to ICH antenna analysis/technical meetings;
- Technical review notes for ongoing ICH Antenna work. Several technical documents per month may need to be reviewed;
- Implementation reports for IO-related actions from DA meetings;
- Implementation reports for Chit resolution from IO and DA design reviews; Amended and reviewed sections of IO schedule;
- Preparation of input documents, presentations, meeting notes related to meetings of DA representatives with IO experts;
- Update and re-evaluate loads, including nuclear loads and other engineering specifications in relation to the ICH antenna work;
- Contributions to design workshops on specific topics;

Travel to the DA or other sites (including conferences) may be required to carry out the work. The related expenses will be reimbursed by the IO in line with the contractual clauses.

7 Responsibilities

7.1 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.

7.2 IO's Responsibilities

The IO shall:

- Nominate the Technical Responsible Officer to manage the Contract;
- Organise a monthly meeting on work performed;
- Provide offices, workstation and software licences at IO premises.
- Provide remote access to IO workstation.

8 List of Deliverables and due dates

The main deliverables are provided in the table below.

D #	Description	Due Dates
D01	Review of the ANSYS model which has been used for the current analysis of the ICH antenna in preparation for the design of a global model.	T0 + 01 months
D02	Preparation of the technical specification for launching the loads which are missing	
D03	Preparation and draft of a report for the proposed global model and the super-element structure which is intended to be used for all future ICH antenna design analysis work.	T0 + 03 months
D04	Generation of, with the necessary available additional expertise, the global model and super-elements.	T0 + 06 months
D05	Preparation of the super-elements which will be made available for use by the ICH antenna design team.	This is an iterative process which will need to be repeated a number of times.
D06	Review (mechanical analysis, seismic analysis, review of conclusions etc.) of the CYCLE technical reports completed on each of the super-elements of the ICH antenna design	
D07	Responsible for the implementation of the .SUB matrix files (from the super-elements) into the global model	
D08	Responsible for ensuring the compatibility of any changed super-elements into the global model	
D09	Responsible for running the global model analysis, producing the necessary updated matrix files for each of the super-elements and writing reports of the analysis and results.	
		T0 + 12 months

(Note: the order of the deliverables may change due to the project needs)

9 Acceptance Criteria

The deliverables will be in the form of reports, specification, procedures and/or minutes which have been submitted for acceptance by the ICH Antenna TRO and which conform to the relevant ITER requirements.

10 Specific requirements and conditions

Minimum 5 years of experience in structural design

Skilled in use of ANSYS and knowledge of sub-structuring methodology

Knowledge of ANSYS for mechanical design checking

Experience with nuclear codes and standards, familiar with the RCC-MRx Design Code.

Expertise in performing numerical engineering analysis

Experience of working with CAD designers

Experience in mechanical fabrication of large components

Ability to work in multidisciplinary, international team environment.

Knowledge of Quality Assurance systems and their practical application (INB Order of 7 February 2012)

Ability to balance quality/risk/cost when providing design information.

Operational experience of procedures in nuclear environment;

Experience relevant to all techniques in deliverables list;

Experience in Mechanical Engineering;

or similarly complex research and engineering environment;

Understanding of schematics and 3D models.

Written and oral communication shall be held in English

11 Work Monitoring / Meeting Schedule

Work is monitored through quarterly reports (see List of Deliverables section) and at monthly project meetings.

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 Procurement Quality Requirements \(ITER_D_22MFG4\)](#).

Prior to commencement of the task, a Quality Plan 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 (see [Procurement Requirements for Producing a Quality Plan \(ITER_D_22MFMW\)](#)).

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, in accordance with [Quality Assurance for ITER Safety Codes \(ITER_D_258LKL\)](#).

13 CAD Design Requirements (if applicable)

For the contracts where CAD design tasks are involved, the following shall apply:

The Supplier shall provide a Design Plan to be approved by the IO. Such plan shall identify all design activities and design deliverables to be provided by the Contractor as part of the contract.

The Supplier shall ensure that all designs, CAD data and drawings delivered to IO comply with the Procedure for the Usage of the ITER CAD Manual ([2F6FTX](#)), and with the Procedure for the Management of CAD Work & CAD Data (Models and Drawings [2DWU2M](#)).

The reference scheme is for the Supplier to work in a fully synchronous manner on the ITER CAD platform (see detailed information about synchronous collaboration in the ITER [GNJX6A](#) - Specification for CAD data production in ITER Contracts.). This implies the usage of the CAD software versions as indicated in CAD Manual 07 - CAD Fact Sheet ([249WUL](#)) and the connection to one of the ITER project CAD data-bases. Any deviation against this requirement shall be defined in a Design Collaboration Implementation Form (DCIF) prepared and approved by DO and included in the call-for-tender package. Any cost or labour resulting from a deviation or non-conformance of the Supplier with regards to the CAD collaboration requirement shall be incurred by the Supplier.

14 Safety requirements

ITER is a Nuclear Facility (“Installation Nucléaire de Base” in the French regulation) identified in France as “INB no. 174”.

In application of the Article 14 of the ITER Agreement, the French Nuclear Regulation must be observed for;

- Protection Important Components and in particular Safety Important Class components (SIC)
- Protection important activities.

The supplier must therefore comply with the all requirements expressed in “*Provisions for implementation of the generic safety requirements by the external interveners*” (SBSTBM)