

Technical Specifications (In-Cash Procurement)

CFE - In-Vessel Diagnostics Finalisation and Implementation

This document describes the technical needs for expert specialists in engineering of Diagnostics. Specifically the technical needs of the Diagnostics Division with particular reference to design development and construction preparation, predominantly in the following areas:

- Mechanical design and integration
- Assessment and justification of engineering designs
- Construction (realization) and Installation preparation

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1 Purpose

This document describes the technical needs for expert specialists in engineering of Diagnostics. Specifically the technical needs of the Diagnostics Division with particular reference to design development and construction preparation, predominantly in the following areas:

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2 Scope

The work aligns with the ITER project, currently under construction in France. This device will study the Fusion concept on a scale previously unequalled on earth. To study the behaviour of this device, a set of monitoring systems (called diagnostics) are required. This will provide all the information to show and understand the performance of the device. The work involves technical expertise for supporting multiple diagnostic projects.

NOTE: There are no Protection Important Activities (PIAs) within the scope of this work.

3 Definitions

CAD	Computer aided design
CMM	Configuration and management model
DA	Domestic Agency
DM	Detailed model
IO	ITER Organization
IO-TRO	ITER Organization Technical Responsible Officer.
UHV	Ultra High Vacuum

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

4 References

Links inserted in text

5 Estimated Duration

The duration shall be for an initial 12 months from the starting date of the task order amendment. Services shall be provided approximately 40% at the IO work site. The IO expect some missions within Europe (to DA and other premises), they will be defined in the course of the contract.

6 Work Description

The work involves technical expertise for multiple ITER diagnostic projects working in close collaboration with the IO-TROs. It involves many areas of activity, including but not limited to:

- Supporting IO design reviews as an expert
- Generating meeting preparatory notes, including agenda and draft attendee selection;

- Producing notes for IO meetings called by interfacing systems and review bodies;
- Drafting minutes for IO and DA meetings;
- Technical input in support of project change requests and other actions;
- Reviewing draft interface sheets;
- Reviewing draft assembly/installation procedures;
- Input documents, presentations and meeting notes related to Interface meetings.
- Technical review notes for DA technical documents in IO IDM. Documents include technical reports, draft deviation requests, compliance and requirements matrixes etc. Several technical documents per month need to be reviewed;
- Engineering design proposals, produced in consultation with interfacing parties and stakeholders (e.g. Design Integration, Safety)
- Input documents, presentations, meeting notes related to Monthly IO or DA meetings;
- Implementation reports for IO-related actions from IO or DA meetings;
- Implementation reports for Chit resolution from IO and DA design reviews; Amended and reviewed sections of IO schedule;
- Record of progress against schedule;
- Schedule improvements and fix scheduling problems;
- Input documents, presentations, meeting notes related to meetings of DA representatives with IO experts;
- Guidance notes for DAs on execution of PA technical activities;
- Updated and re-evaluated loads, including nuclear loads and other engineering specifications;
- Contributions to design workshops on specific topics (e.g. shutters, neutronics);
- Technical requirements collection and production of Technical Specifications, including follow up/oversight of Third Parties (e.g. DAs, manufacturers, etc.);
- Review and iteration of 2D drawings and diagrams (e.g. cabling diagrams, P&IDs) produced by Third Parties;
- Review and iteration of technical documents (e.g. Design Description Documents, Maintenance and Inspection procedures, Technical Specifications) produced by Third Parties;
- Input documents, presentations, meeting notes related to workshops and conferences. Travel to the DA or other sites in Europe may be required to carry out the work.

Within the broader topics listed above, the work will predominantly focus on the following four main activities in support of the In-Vessel Diagnostics systems.

6.1 55.NE.C0 Cryostat Electrical Feedthroughs

There are nine Electrical Feedthrough assemblies (EFTs) located on the Cryostat boundary, which form part of the signal chains for the magnetic diagnostics (pick-up coils, flux loops) mounted on the outside of the ITER Vacuum Vessel. The EFTs have a variety of signal capacities ranging between 52 and 365 pins, including both low voltage and thermocouple signals.

Whilst these EFTs are not safety important components, they nevertheless have strict quality and vacuum compatibility requirements in order to achieve the required high level of

performance. Adherence to the requirements for Vacuum Quality Class 2 (VQC 2) from the ITER Vacuum Handbook (ITER_D_2EZ9UM) is mandatory.

The Contractor shall gather the relevant requirements for the EFTs from Interface Sheets, the aforementioned Vacuum Handbook and other Input Documents, to produce Technical Specifications and design documents suitable for procurement by a Third Party. The Contractor shall then perform follow-up/oversight of the Third Party to ensure the specified requirements are met.

6.2 Engineering Work Packages

Installation of ITER diagnostic systems, starting with those on the outside of the Vacuum Vessel, will commence in the near future. In preparation for these activities, IO is producing outline installation documents, drawings and diagrams, which are further elaborated by IO's installation contractor.

The Contractor shall perform a peer review of the IO generated input documents and drawings, to ensure they are consistent and easily understandable by Third Parties. Once the installation contractor has produced their detailed documents and drawings, the Contractor shall review them, including a comparison with the original IO documents and checking the validity of any additional procedures, tests or modifications proposed by the installation contractor.

6.3 55.NE.V0-EFT Electrical Feedthroughs integration

There are approximately 80 55.NE.V0-EFT Electrical Feedthroughs located in the Upper and Lower Ports of the ITER tokamak. These EFTs transmit signals and power between the diagnostic systems located inside the Vacuum Vessel (e.g. on the VV walls, Divertor or in Diagnostic Racks) and the Tokamak Building. They are Protection Important Components (PIC) because they form part of the primary confinement boundary of the machine.

The feedthroughs have a large number of interfaces, both physical (e.g. the interfacing components to which they are attached or nearby systems which pose hazards to them) and functional (e.g. the client diagnostic systems whose signals and power the feedthroughs transmit).

The Contractor shall work on the physical integration of the feedthroughs, ensuring the physical interface requirements are correctly implemented and respected. The associated activities include:

- Implementation of Service Vacuum System (SVS) monitoring pipework, including design and justification of the pipework and supports, in conjunction with Design Integration and Holistic Integration teams
- Development of physical protection measures/deformable bumpers to protect the feedthroughs from the hazards of pipe whipping in adjacent high energy lines
- Design of electrical insulation/isolation measures and grounding strategies considering the feedthroughs and their associated air-side connectors
- Integration of the feedthrough mineral insulated cable tails in the marshalling areas inside the Vacuum Vessel Upper and Lower Ports, including development and assessment of clamps, supports and connector boxes

6.4 In-Vessel Electrical Services transmission line consistency verification

As noted above, the In-vessel Electrical Services provide the signal and power transmission lines between a sensor (e.g. magnetic pick-up coil, bolometer, thermocouple) mounted on the Vacuum Vessel wall, Divertor cassette or Diagnostic Rack and the Feedthroughs at the Vacuum Vessel boundary. Due to the complex nature of the system, it is split into multiple work packages being designed and developed by various teams.

Through the review of documents produced by the different teams, either in IO or the DAs, the Contractor shall review the end-to-end design of the In-Vessel Electrical Services to check that the performance and interfacing requirements are satisfied in a consistent way. This check shall be summarised in a report, describing the documents which have been reviewed, any issues detected and proposals to resolve the issues.

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;
- Provide monthly schedule updates for the tasks being worked on by the Contractor;
- 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 rules.

7.2 IO's Responsibilities

The IO shall:

- Nominate a Responsible Officer to manage the Contract;
- Organise a monthly meeting(s) on work performed;
- Provide offices at IO premises;
- Review documents in a timely fashion

8 List of Deliverables and due dates

D #	Description	Due Dates
D1	Design and procurement package for 55.NE.C0 Cryostat Electrical Feedthroughs	T0 + 3 months
D2	Peer review of Engineering Work Packages for VV-mounted components	T0 + 6 months
D3	Port Cell integration of 55.NE.V0-EFT Electrical Feedthroughs	T0 + 9 months
D4	In-Vessel Electrical Services transmission line consistency verification	T0 + 12 months

9 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 8.

10 Specific requirements and conditions

The personnel proposed by the Contractor to carry out the work described in Section 6 must have:

- A professional qualification in engineering with relevant experience in engineering design in a complex technical environment;
- Good technical writing skills;
- Good inter-personal skills;
- The ability to be consistent and work well under pressure with good attention to detail;
- Capability to work in English language, both verbally and written;
- Able to work with partners and the ITER host to define critical needs;
- Ability to align work priorities with overall project schedule;

Experience in the following areas is required:

- Design of diagnostics for large fusion installations and knowledge of ITER diagnostic systems;
- Design of mechanical or electrical components for high vacuum environments;
- Experience of working with and specifying mineral insulated cabling;
- Development of equipment designs for fusion facilities;
- Operational experience of large fusion devices;
- R&D oversight experience;
- Experience of techniques and hardware in deliverables list;
- Schematics definition;
- Design organization;
- Technical document generation;
- System requirements management;
- Technical risk analysis

11 Work Monitoring / Meeting Schedule

Work is monitored through monthly project meetings as required (the frequency of meetings can be increased through agreement between the Contractor and the IO TRO).

12 Delivery time breakdown

See Section 8, “List of Deliverables and due dates”.

13 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 Software qualification policy ([Software Qualification Policy \(ITER_D_KTU8HH\)](#)).

14 CAD Design Requirements

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 ([ITER_D_2F6FTX](#)), and with the Procedure for the Management of CAD Work & CAD Data (Models and Drawings [ITER_D_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_D_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 ([ITER_D_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.

15 Safety requirements

ITER is a Nuclear Facility identified in France by the number-INB-174 (“Installation Nucléaire de Base”).

For Protection Important Components and in particular Safety Important Class components (SIC), the French Nuclear Regulation must be observed, in application of the Article 14 of the ITER Agreement.

In such case the Suppliers and Subcontractors must be informed that:

- The Order 7th February 2012 applies to all the components important for the protection (PIC) and the activities important for the protection (PIA).
- The compliance with the INB-order must be demonstrated in the chain of external contractors.
- In application of article II.2.5.4 of the Order 7th February 2012, contracted activities for supervision purposes are also subject to a supervision done by the Nuclear Operator.

For the Protection Important Components, structures and systems of the nuclear facility, and Protection Important Activities the contractor shall ensure that a specific management system is implemented for his own activities and for the activities done by any Supplier and Subcontractor following the requirements of the Order 7th February 2012 ([PRELIMINARY ANALYSIS OF THE IMPACT OF THE INB ORDER - 7TH FEBRUARY 2012 \(AW6JSB v1.0\)](#)).

Compliance with [Defined requirements for PBS 55 - Diagnostics \(NPEVB6 v2.0\)](#) or its flowed down requirements in [SRD-55 \(Diagnostics\) from DOORS \(28B39L v5.2\)](#) is mandatory.

NOTE: There are no Protection Important Activities (PIAs) within the scope of this work.

