

Technical Specifications (In-Cash Procurement)

Electrical Services and Magnetic Diagnostics Preparation and Installation

CFE -

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 for electrical services and in-vessel diagnostics :

Monitoring of design development and justification Installation preparation Installation follow-up and monitoring Requirements management, validation and ...

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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 for electrical services and in-vessel diagnostics :

- Monitoring of design development and justification
- Installation preparation
- Installation follow-up and monitoring
- Requirements management, validation and verification
- Simulation and data analysis

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: Some work performed by the Contractor related to Section 6.3 may be classified as Protection Important Activities (PIAs).

3 Definitions

CAD	Computer aided design
CMM	Configuration and management model
DA	Domestic Agency
DM	Detailed model
EWP	Engineering Work Package
HOP	Hand-Over Package
IO	ITER Organization
IO-TRO	ITER Organization Technical Responsible Officer.
PLM	Product Lifecycle Management
sSRD	Sub-System Requirements Document
TAC	Tokamak Assembly Contract
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 contract duration shall be for 12 months. Work shall not commence until the contract has been signed by both parties. Services are to be provided mainly off-site, with two visits per

week to the IO site for meetings, or as per business requirements. Related to the foreseen installation activities (see Section 6.2), the Contractor may be required to work outside ITER Organization reference working hours, including nights, weekends and public holidays.

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:

- 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. 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 Chit resolution from IO and DA design reviews;
- Record of progress against schedule, with proposals for improvements;
- Input documents, presentations, meeting notes related to meetings of DA representatives with IO experts;
- Updated and re-evaluated loads, including nuclear loads and other engineering specifications;
- Technical requirements collection and production of Technical Specifications, including follow up/oversight of Third Parties (e.g. DAs, manufacturers, etc.);
- 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.
- Coordination of shipments of components between IO and Suppliers;
- Drafting installation specifications;
- Support to update of 3d models

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 five main activities in support of the In-Vessel Diagnostics systems.

6.1 Preparation for steady state sensor on-site installation

The steady state sensors are Hall-effect magnetic sensors, located on the outside of the ITER vacuum vessel, which measure the local steady state magnetic field in directions normal and tangential to the vacuum vessel surface. The sensors were manufactured and are currently being calibrated before installation on three sectors of the vacuum vessel (sectors 2, 5 and 8).

The Contractor shall perform, in conjunction with the TRO, steady state sensor activities related to the Tokamak Assembly Contract and sensor installation on the vacuum vessel. The Contractor shall develop technical specifications, on-site assembly plans (installation sequence and main operations) and other TAC-related documentation applicable to sensor installation on VV sectors. The Contractor shall assist procurement and follow-up of steady state sensors on-site installation jigs and dummies, and actively participate in technical meetings with TAC Contractors. The Contractor shall coordinate the shipments of sensors between IO and Suppliers.

6.2 Steady state sensor delivery and on-site installation activities

The Contractor shall develop, perform and document steady state sensors Site Acceptance Test and other on-site-delivery related logistics activities. The Contractor shall generate timely updates of the steady state sensors CAD models to match as-built vacuum vessel sector data (Third Party CAD resources will be provided by IO). The Contractor shall monitor sensor installation activities performed by the TAC contractor, and provide guidance to the TRO related to installation processes such as rework decisions and specific on-site installation hold points, as specified in the sensor on-site assembly plan.

6.3 55.NE.V0 Electrical feedthroughs manufacturing

Following completion of the Final Design Review, the 55.NE.V0 electrical feedthroughs for ITER will soon enter the manufacturing phase, under the responsibility of the European Domestic Agency. The Contractor shall perform a peer review of the documents (e.g. manufacturing technical specifications) and drawings provided as input information for the manufacturing contract, checking consistency between the documents, diagrams and drawings, and ensuring requirements are correctly implemented

The Contractor shall actively participate in the Manufacturing Readiness Review and shall perform follow-up of any actions resulting from the review, to ensure they are completed in a timely manner. This work will involve interactions with key teams at IO and in the Domestic Agencies.

The Contractor shall follow up the manufacturing activities, reviewing documents produced by the selected contractor. As part of this peer review process, the Contractor shall perform calculations including nuclear activation analysis, dose rate evaluations and extrapolation of mechanical fatigue analysis, in order to provide independent checks of any modifications which occur during manufacturing. The IO has some existing tools for these calculations, but the Contractor may be required to modify them for specific tasks.

NOTE: calculations related to nuclear safety may be classified as Protection Important Activities (see Section 15).

6.4 55.NE.C0 Cryostat electrical feedthroughs Final Design support

The 55.NE.C0 Cryostat electrical feedthroughs underwent their Preliminary Design Review in March 2020 and are now moving into the Final Design phase.

The Contractor shall provide support to the final design activities, including arranging and supervising CAD activities (CAD resources will be provided by IO), writing and reviewing documents such as Interface Sheets, assembly plans and procedures, analysis reports, design description documents, decommissioning plans and technical specifications.

6.5 Requirements management, verification and validation

The sub-System Requirements Document (sSRD) is a key document for any ITER diagnostic system, as it lists the requirements to which the system must be designed, manufactured, installed and operated. The sSRD takes the higher level technical and safety requirements which have been produced for all ITER diagnostics, and refines them into more detailed requirements, specific for the given system.

sSRDs for the 55.NE Electrical Services have been produced, and the Contractor shall now produce and keep updated Design Compliance Matrices to track the verification and validation of the sSRD requirements, based on R&D results, manufacturing tests, analysis reports, etc. as the system maturity increases. The Contractor shall highlight to the TRO any requirements for which sufficient substantiation is not available, and propose to the TRO potential methods to obtain the substantiation.

6.6 Engineering Work Packages and PLM Hand Over Packages

Installation of ITER diagnostic systems inside the Vacuum Vessel will commence in the near future. In preparation for these activities, IO is producing installation documents, drawings and diagrams, which will be further elaborated by IO's installation contractor.

The Contractor shall liaise with system TROs in order to create detailed technical design documents, procedures and drawings/diagrams for diagnostics EWPs. The Contractor shall ensure the documents are consistent between different diagnostic systems, and easily understandable by Third Parties. The Contractor shall coordinate and manage the implementation of diagnostic technical documents in the PLM system and creation of Hand Over Packages (HOPs). 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 check of the validity of any additional procedures, tests or modifications proposed by the installation contractor.

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	Summary report of preparation for steady-state sensors installation (including links to reports, meeting minutes and technical specifications produced and uploaded in IO IDM)	T0 + 2 months
D2	Summary report of 55.NE.V0 feedthroughs manufacturing activities (including links to reports that have been reviewed, independent calculations that have been produced, meeting minutes and records of actions to be performed)	T0 + 4 months
D3	Summary report of EWP and PLM Handover Packages (including links to documentation produced and uploaded in IO IDM for three EWP and PLM Handover Packages)	T0 + 6 months
D4	Requirements Validation and Verification package (including two updated Design Compliance Matrices with clear substantiation of applicable requirements)	T0 + 8 months
D5	Summary report of 55.NE.C0 Cryostat feedthroughs Final Design support (including links to reports that have been reviewed, independent calculations that have been produced, meeting minutes and records of actions to be performed)	T0 + 10 months
D6	Summary report of steady-state sensors delivery and installation (including links to SAT reports, meeting minutes and technical documentation produced and uploaded in IO IDM)	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 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;
- R&D oversight experience;
- Experience of techniques and hardware in deliverables list;
- Design organization;
- Technical document generation;
- System requirements management;
- Technical risk analysis
- High level of proficiency in Dassault Enovia Matrix PLM, Intergraph SmartPlant Foundation and IBM Rational DOORS software

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_GNIX6A](#) - 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 (including [Provisions for Implementation of the Generic Safety Requirements by the External Actors/Intervenors \(SBSTBM v2.2\)](#)).
- 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: Some work performed by the Contractor related to Section 6.3 may be classified as Protection Important Activities (PIAs).