

Technical Specifications (In-Cash Procurement)

CFE - Electrical engineering support for diagnostic port integration

This document describes technical specification for the engineering work required to integrate the electrical services in the diagnostic upper and equatorial port.

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1 Purpose

This document describes technical specification for the engineering work required to integrate the electrical services in the diagnostic upper and equatorial port.

ITER diagnostic port is composed of three integration zones: the port plug, the port interspace and the port cell. The port plug is in vacuum and the others are in the atmospheric condition. The port has several tenant systems such as diagnostic systems, DMS (Disruption Mitigation System), GDC (Glow Discharge System). The components of each tenants system are installed in the three integration zones, depending on the tenant need. See Figure 1. Figure 2 shows one example of the electrical services within the port plug, which is called LEVI (Loom Electrical Vacuum Interfaces).

One of the main port integration activities is to install the electrical lines for the components such as detectors, shutters, electrode, thermocouples, power unit, etc., in order to provide electric power and transfer signals. The following aspects, which are not exclusively listed, need to be considered for the electric service integration:

- Electrical characteristics
- Electrical cross-talk, Paschen effect, insulation requirements
- ITER environment: vacuum, temperature, radiation, fire, magnetic field, etc.
- Vacuum requirement for the in-vacuum components
- RH handling requirement
- Maintenance requirement
- Mechanical interface with the tenant components and the port environment

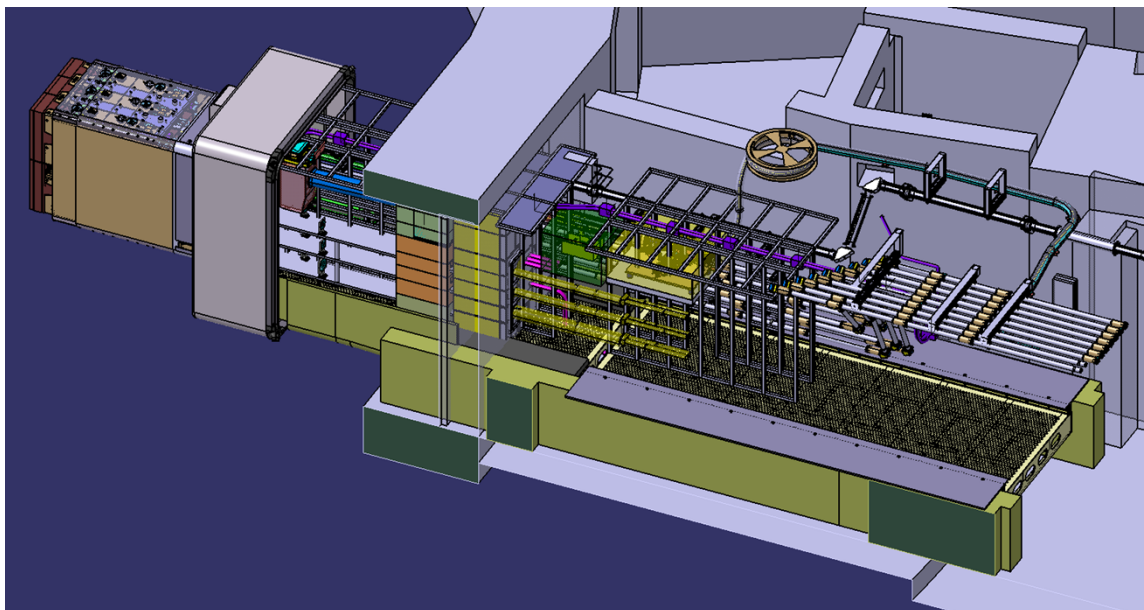


Figure 1 General layout of diagnostic port in ITER

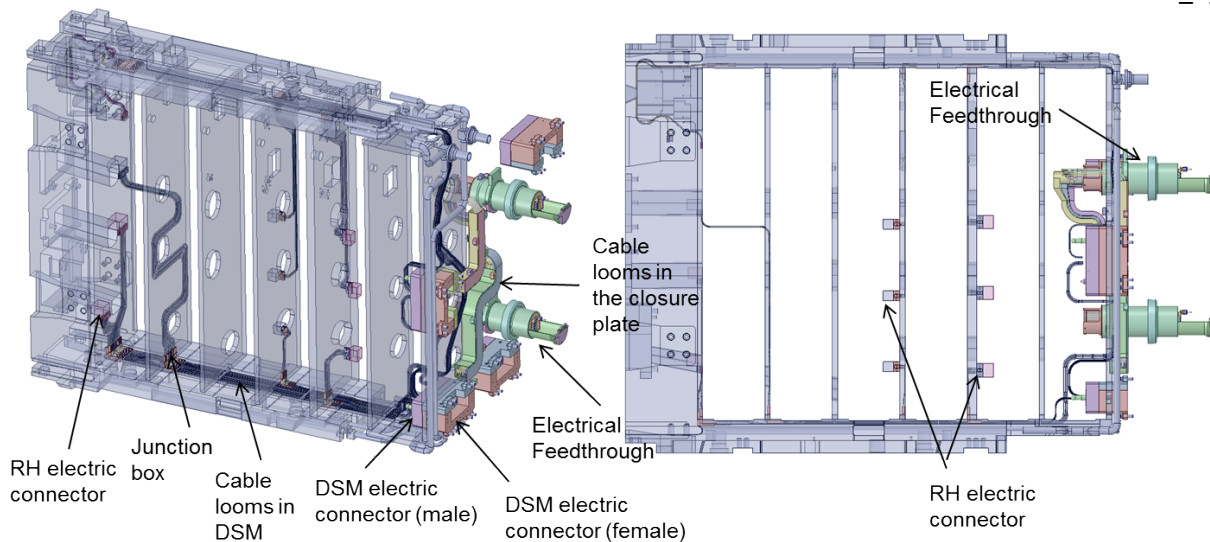


Figure 2 LEVI design in one DSM of Equatorial Port Plug #12

2 Scope

The work scope of this task is to provide technical expertise and engineering support for the development of the electrical services (cables, connectors, electrical feedthroughs, etc) and the integration into the port. It will include the following activities, which are not exclusively listed:

- Design development of LEVI into the port plug
- Development and integration of electrical services in the port interspace and port cell
- Interface management and coordination related electrical services between port integration and the tenant systems
- Establishment of electrical requirements

The contractor need to consider the following ports and their tenant systems which will have the same design concept for the electrical services.

- Equatorial ports: #2, #8, #11, #12, #17
- Upper ports: #2, #4, #5, #6, #7, #8, #9, #11, #14, #18

3 Definitions

BOM: Bill of Material

DMS: Disruption Mitigation System

DSM: Diagnostic Shield Module

FDR: Final Design Review

GDC: Glow Discharge System

IO: ITER Organization

IO-TRO: ITER Organization technical Responsible Officer

ISS: Interspace Support Structure

LEF: LEVI Electrical Feedthrough

LEVI: Loom Electrical Vacuum Interfaces

MI: Mineral Insulated
PCSS: Port Cell Support Structure
PP: Port Plug
RH: Remote Handling
TRO: Technical Responsible Officer
UPP: Upper Port Plug

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

4 Estimated Duration

Services are to be provided for 100% of the time at the IO-CT work site. The duration shall be for 12 months from the start date of on-site work.

5 Work Description

The contractor shall provide the technical expertise and engineering support for the design development of the electrical services in the ports. It is required to work full time at the IO-CT work site and interact with the IO Technical Responsible Officers (TROs) which are in charge of the systems interfacing the electrical services.

5.1 Coordination of all the electrical needs and requirements

The following information shall be collected from the diagnostic systems installed in the port plugs listed in Section **Error! Reference source not found.**

- Number of cables and pins
- Cable type
- Electrical characteristics of the signal: frequency, power, voltage, current, etc.
- Other requirements, e.g., signal category such as basic machine control, machine protection, etc.

The contractor should collaborate with the PI and tenant TROs in order to ensure that the cable diagrams are consistent with the inputs provided for the LEVI design. During this process, he needs to help and support the TROs to select proper cables.

5.2 Design development of electrical components

The contractor shall provide engineering support and expertise to design and develop the electrical components.

- Technical follow-up of the design development for LEVI
- Propose the technical solution for the design issues
- Develop the design for the cable connections between ex-vessel components: port plug to ISS, ISS to PCSS, PCSS to port cell wall
- Preparation or review of technical documents such as technical specification, design description, design justification, test plan, assembly plan, etc.

5.3 Integration of electrical services in the port

In each diagnostic port listed in Section 2, there are several tenants systems to require electrical services to transfer power or signals. And these electrical lines need to be connected to the ex-vessel cables (55.NE.X0 scope) and the ITER electrical network (PBS.44 cable trays).

The contractor shall coordinate the integration of electrical services in the port. The priority should be given to the first plasma ports, and then the ports of which design review is planned.

- Finalization of the cable needs and support of cable diagram update
- Detailed layout of electrical services: location of LEF and DSM electric connector on the closure plate, cable routing in the port plug, positioning of RH electric connector
- Cable arrangement in the RH connector and DSM connector
- Coordination of BOM for electrical components
- Ex-vessel cable and connector arrangement in collaboration with 55.NE.X0 in the port interspace and port cell

5.4 Technical specification of the LEVI electric components

The LEVI electric components are developed as a standard design solution for the diagnostic systems. So it is necessary to prepare the technical note which specifies technical data (material, voltage, current, frequency, leak tightness, radiation hardness, temperature range, etc.) and design constraint/interfaces so that the user can select the component properly.

The contractor shall prepare the technical specification for the following LEVI components, based on the outcomes drawn up during the IO design development activities:

- LEF including hermetic electric connector in LEF
- DSM electric connector
- Flexible cables between LEF and DSM connector
- MI cable
- RH connector

5.5 Other technical support

The contractor shall provide the following technical support;

- Preparation and follow-up of the technical meetings
- Prepare the FDR: agenda, notification, input document package, etc.
- Post-FDR activities such as chit resolution action plan and follow-up

6 Responsibilities

6.1 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.

6.2 IO's Responsibilities

The IO shall:

- Nominate the Responsible Officer to manage the Contract;
- Organise progress meetings on work performed;
- Provide offices at IO premises.

7 List of Deliverables and due dates

The main deliverables are provided in the table below.

D #	Description	Due Dates
D01	Outcome of integration of electric services in equatorial ports <ul style="list-style-type: none"> List of cable needs and cable diagrams Detailed layout of electrical services BOM of electrical services Ex-vessel cable arrangement 	T0 + 6 months
D02	Outcome of integration of electric services in Upper ports <ul style="list-style-type: none"> List of cable needs and cable diagrams Detailed layout of electrical services BOM of electrical services Ex-vessel cable arrangement. 	T0 + 11 months
D03	Collection of LEVI components needs/requirements from Port integration and tenants <ul style="list-style-type: none"> Cable types, number of cables, connectors, LEF, Signal characteristics others 	T0 + 8 months
D04	Technical specification of LEVI components specified in section 5.4	T0 + 7 months
D05	Summary of the technical support: list of document reviews, minutes of technical meetings, etc.	T0 + 12 months

8 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, Table of deliverables.

9 Specific requirements and conditions

Person(s) to carry out the work described in this document must have proven experience, as appropriate.

- Design and Development of equipment designs for fusion or nuclear facilities;
- Experience in electrical engineering;
- Experience in diagrams (single line diagram, cable diagram);
- Experience in radiation hardness of material and electronics;
- Experience in vacuum engineering;
- Monitoring and reporting of status of projects;
- Generation of technical, administrative, and managerial documents;
- Communication with international local and remote teams in context of nuclear fusion research or similarly complex research and engineering environment;
- Organization, taking minutes and action tracking of international meetings;

10 Work Monitoring / Meeting Schedule

Work is monitored through reports on deliverables (see List of Deliverables section) and at progress meetings.

11 Delivery time breakdown

See Section 8 “List Deliverables section and due dates”.

12 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 tasks, a Quality Plan (ITER_D_22MFMW) shall be submitted for IO's approval giving evidence of the above and describing the Supplier's organisation for this task; the skill of workers involved in the tasks; any anticipated sub-suppliers; and giving details of who will be the independent checker of the activities.

Deviations and Non-conformities shall follow the procedure detailed in IO document MQP Deviations and Non Conformities (22F53X). Prior to delivery of any manufactured items to the IO Site, a Supplier Release Note shall be signed (ITER_D_22F52F) by IO.

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).

13 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.