Technical Specifications (In-Cash Procurement)

Technical Specification for a High-Voltage Insulation Engineer

This technical specification describes Engineering Work for the Instrumentation of Coils and Feeders from the ITER Magnet System, and includes contract follow-up outside of the IO premises in the different Member Countries. The position is for a high-voltage insulation engineer.

<table>
<thead>
<tr>
<th>Approval Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>Author</td>
</tr>
<tr>
<td>CoAuthor</td>
</tr>
<tr>
<td>Reviewers</td>
</tr>
<tr>
<td>Approver</td>
</tr>
</tbody>
</table>

Document Security: level 1 (IO unclassified)
RO: Foucher de Brandois Cécile

Read Access
RO, project administrator, LG: Admin Tokamak, LG: Magnet division's external secretary, GG: IO DDGs (and Senior Advisors), AD: Division - Procurement and Contract, AD: Directorate - Tokamak
# Table of Contents

1 PURPOSE ............................................................................................................................ 2  
2 SCOPE ................................................................................................................................. 2  
3 DEFINITIONS .................................................................................................................... 2  
4 ESTIMATED DURATION ..................................................................................................... 2  
5 WORK DESCRIPTION .................................................................................................. 2  
6 LIST OF DELIVERABLES AND DUE DATES ............................................................. 3  
7 ACCEPTANCE CRITERIA ............................................................................................ 3  
8 SPECIFIC REQUIREMENTS AND CONDITIONS ...................................................... 3  
9 WORK MONITORING / MEETING SCHEDULE ....................................................... 4  
10 PAYMENT SCHEDULE / COST AND DELIVERY TIME BREAKDOWN .......... 4  
11 TRAVEL EXPENSES AND RELATED PAYMENT CONDITIONS .................... 4  
12 QUALITY ASSURANCE (QA) REQUIREMENT .................................................... 4
1 Purpose
This technical specification describes Engineering Work for the Instrumentation of Coils and Feeders from the ITER Magnet System, and includes contract follow-up outside of the IO premises in the different Member Countries. The position is for a high-voltage insulation engineer.

2 Scope
The work to be developed within this contract falls within the domain of the design of high-voltage components for the ITER superconducting magnet systems with applications hence to cases where the presence of low temperature and high ionizing radiation doses are added as constraints.

The operation of a superconducting tokamak demands the application of fast pulses to the superconducting coils and busbars by using switching networks in order to initiate and shape the high-current plasmas. Those fast pulses applied to magnets with large stored energies imply that the magnet must be designed to withstand high voltages to ground (in the order of a few tens of kV). The conditions for vacuum and low temperature are such that Paschen conditions could occur, enhancing electrical discharges which may endanger the coil integrity. The instrumentation systems have to be compliant with the astringent conditions, and qualification voltages for the components can go as high as 56 kV for some critical elements.

The list of components which are to be produced through industrial contracts includes:
- insulating breaks – more than 1300 units for both room temperature and cold units;
- instrumentation feedthroughs (vacuum-to-air) – about 1300 units for multi-pin connections;
- instrumentation cables – more than 80 km;
- voltage taps and current-limiting resistors for superconducting coils, bus bars and current leads – around 4000 measuring points

3 Definitions
DA Domestic Agency
QA Quality Assurance
CAD Computer-Aided Design
IDM ITER Document Management system

4 Estimated Duration
This contract duration shall be 2 years. The IO may extend these services for an additional period of one year.

5 Work Description
- Keep updated the baseline documents in IDM for insulating breaks, high voltage feedthroughs, instrumentation cables and current limiting resistors / voltage taps
- Keep updated the contractual documents for the components above
Detailed follow up of the contracts which have been set up in this domain to supply the high voltage instrumentation components to be installed at the ITER machine. This follow-up includes:

- technical visits and preparation of corresponding reports
- management of QA, Manufacturing and Inspection Plans and related documents
- management of non-conformities
- reporting of conflicts and serious concerns which might jeopardize the achievement of objectives within schedule and budget

Follow up of validation tests at qualified experimental stations, preparation of specifications and test programmes; at the end of the process analysis of the results and feedback of the lessons learnt into the series production

Participation to the integration of the high voltage instrumentation components in 3D CAD models

Participation to the discussions with ITER DAs related to the integration and functioning of the high voltage instrumentation components according to the technical specifications and the machine environment

Participation to the documentation describing the integration and installation of high voltage instrumentation components during the magnets (coils, feeders, structures) assembly process

6 List of deliverables and due dates

- Monthly, yearly and final reports are the deliverables measuring the accomplishment of the objectives;
- Scientific publications should be prepared if deemed necessary.

7 Acceptance Criteria

The acceptance of the work will be based on the examination of the content of each of the specified reports in accordance with the description of the work given in Section 5.

8 Specific requirements and conditions

In terms of qualification and experience, the contractor shall have:

- a Master’s degree in engineering (Electrical, Composite Materials and Insulations);
- at least 10 years post graduate experience in high-voltage electrical engineering, related materials and the problems associated with cryogenic vacuum systems;
- experience in the effects of radiation on electrical insulation materials will be an advantage;
- familiarity with magnets design and superconductivity;
- it is absolutely required that the person is proficient in English to communicate and write technical reports and specifications in English.

Other requirements:

- A work plan shall be established and agreed by IO every two months. Travelling and missions shall be only upon agreement with IO;
- This contract shall be executed by a single staff. Splitting it into parts and sharing those between several parties or individuals are not permitted;
- The staff working on this contract shall be available full time and deployed to the IO site in St Paul-lez-Durance, France.
9 Work Monitoring / Meeting Schedule
Regular meetings will take place to make sure all the information for the development of activities is available; the frequency of those meetings should be at least once a week.

10 Payment schedule / Cost and delivery time breakdown
Instalments shall be made after approval of the periodic technical reports.

<table>
<thead>
<tr>
<th>Deliverables</th>
<th>Payments in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Monthly reports</td>
<td>70</td>
</tr>
<tr>
<td>2 Yearly reports</td>
<td>20</td>
</tr>
<tr>
<td>1 Final report</td>
<td>10</td>
</tr>
</tbody>
</table>

11 Travel Expenses and related payment conditions
For travel, subsistence and other expenditure incurred in the missions done by the contractor staff (one person) to accomplish the work above described, a budget of 30 k€ per year (about 12 missions per year so about 1 mission/month) is fixed. Cost will be sustained by the contractor, and then invoiced to ITER.

12 Quality Assurance (QA) requirement
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)).

Prior to commencement of any manufacturing, a Manufacturing and Inspection Plan must be approved by ITER who will mark up any planned interventions (see Requirements for Preparing and Implementing a Manufacturing and Inspection Plan (ITER_D_22MDZD)).

Deviations and Non-conformities will follow the procedure detailed in ITER Requirements Regarding Contractors Deviations and Non Conformities (ITER_D_22F53X).

Prior to delivery of any manufactured items to the IO Site, a Release Note must be signed in accordance with ITER Requirements Regarding Contractors Release Notes (ITER_D_22F52F).

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).