Call for Expertise in Support of the Electro-Magnetic Analysis of the ITER Magnets

Technical Specification
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Revision history

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<th>Date</th>
<th>Rev.</th>
<th>Note</th>
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<tr>
<td>14/05/2012</td>
<td>Vs. 1.0</td>
<td>Initial draft</td>
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</table>
1 Abstract

This technical specification describes analysis work in support of the manufacturing of the ITER superconducting magnets and its components.

The ITER experimental device contains powerful superconducting magnets to generate and stabilize the deuterium-tritium plasma. The ITER magnet division requires support to address urgent issues related to the coil instrumentation and AC losses.

2 Background and Objectives

The ITER superconducting magnet system consists of 18 TF coils, 6 PF coils, a Center Solenoid (CS) with its 6 modules, 18 Correction Coils (CC) and a superconducting Feeder system. The magnet and feeder systems are in early procurement stages in the different domestic agencies.

The finalization of the design of the coil instrumentation and start of procurement of related systems is now a high priority. Certain coil analysis activities have not advanced in recent years due to lack of man-power, among them the AC loss analysis.

All of the above requires support, which is to be provided through this contract.

3 Work Description

The following scope of work requires special expertise in the field of TRAPS AV, a special superconducting magnet simulation tool developed by CEA/France.

Scope of work:

The scope of this contract includes:

- AC loss computation for all ITER coils in Traps AV.
- Preparation of inputs related to studies concerning the routing of the instrumentation wires and cables for quench detection. Several options must be considered, in agreement with the quench detection design
- Small length initiated quench propagations must be explored with a parametric study (field, current), in order to check compatibility with respect to quench detection settings. This must be done for the CS, PF, and CC coils. Supermagnet code will be used
- Hot spot criterion with all cable components must be recalculated (up to now, only strands included); application to the different conductor types
- Results of CREATE concerning VDE-induced signals across TF instrumentation must be confirmed by TrapsAV
- Co-wound tape-based quench detection is envisaged on the CS, estimations of the inductive voltage collected in the co-wound tape should be finalized and compared to the results from MIT. Preparation of a final comparative report
- Quench propagation studies are in progress in CEA, the follow-up of these must be done, and the conclusions on TF quench detection must be prepared in a form of a report
- Write functional specifications for quench detection electronics
- Follow-up of contracts (optional)
4 Duration

- The framework contract duration shall be two years. The IO may extend these services for a maximum of one year. ITER Organization shall establish the request for services on ad hoc basis and relative to the respective annual work plan.

5 Deliverables and Time Schedule

<table>
<thead>
<tr>
<th>Deliverable</th>
<th>Report</th>
<th>Deadline</th>
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<tbody>
<tr>
<td>1.1</td>
<td>AC loss computation in Traps AV</td>
<td>t0+2m</td>
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<tr>
<td>2.1</td>
<td>Inputs for studies concerning the routing of the instrumentation wires and cables for quench detection.</td>
<td>t0+3m</td>
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<tr>
<td>2.2</td>
<td>Quench propagations parametric study in the CS, PF, and CC coils with Supermagnet.</td>
<td>t0+5m</td>
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<tr>
<td>1.2</td>
<td>AC loss computation in Traps AV for the TF coils</td>
<td>t0+6m</td>
</tr>
<tr>
<td>2.3</td>
<td>Recalculation of hot spot criteria for the different conductor types</td>
<td>t0+8m</td>
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<tr>
<td>1.3</td>
<td>AC loss computation in Traps AV for the PF coils</td>
<td>t0+10m</td>
</tr>
<tr>
<td>2.4</td>
<td>Cross-check of TrapsAv and Carriddi for the VDE-induced signals across TF instrumentation</td>
<td>t0+12m</td>
</tr>
<tr>
<td>1.4</td>
<td>AC loss computation in Traps AV for the CS coils</td>
<td>t0+14m</td>
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<tr>
<td>2.5</td>
<td>Estimations of the inductive voltage collected in the co-wound tape in the CS coils, comparison to MIT results</td>
<td>t0+16m</td>
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<td>2.6</td>
<td>Summary of the follow-up of quench propagation studies in CEA, Conclusions on TF quench detection system requirements</td>
<td>t0+18m</td>
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<tr>
<td>1.5</td>
<td>AC loss computation in Traps AV for the CC coils</td>
<td>t0+20m</td>
</tr>
<tr>
<td>2.7</td>
<td>Write functional specifications for quench detection electronics</td>
<td>t0+22m</td>
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In addition activity summary reports have to be submitted every 6 months to IO.

6 Acceptance Criteria (including rules and criteria)

The acceptance of the work is based on the examination of the content of each of the specified reports in accordance with the description of the work given in Section 3.

7 Payment schedule / Cost and delivery time breakdown

The payments shall be granted following this schedule:
Pay travel invoices immediately after invoicing.
The payments shall be granted on a monthly basis following invoicing for actual work performed.

8 Experience

The staff proposed by the bidder to carry out the work described in Section 3 must have proven experience in following areas:

- Proven experience in use of the TRAPS AV code;
- Proven experience in electromagnetic simulation, and specifically in the simulation of quench detection systems for superconducting coils of ITER;
- Proven experience in working in an international environment;

Curriculum Vitae showing evidence of the above is required.

9 Work condition

- Work plan for every two months is established and agreed by IO. Travelling and missions shall be only upon an agreement with IO.
- This contract shall be executed by one staff. Splitting it into parts and sharing is not acceptable.
- The contractor will be expected to work full-time on site and will be provided with computing resources and the necessary data and documents either in paper or in computer files form.

10 Timetable

The tentative timetable is as follows:

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
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<tbody>
<tr>
<td>Call for Nomination</td>
<td>June 2012</td>
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<tr>
<td>Start of Contract</td>
<td>September 2012</td>
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11 Candidature

Participation is open to all individuals, companies or consortia which are legally registered in one or more of the ITER Member States. A consortium may be either a permanent, legally-established grouping or a grouping which has been constituted informally for a specific tender procedure. All members of a consortium (i.e. the leader and all other members) are jointly and severally liable to the ITER Organization.

The consortium groupings shall be presented at the tender submission stage. The consortium cannot be modified later without the approval of the ITER Organization.