Magnet HV Signal Conditioning & Remote Input Output Design, development, qualification and series production

Phase 1: prototype design, development and qualification

Call for nomination (C4N)
Summary of Technical Specifications

1 Purpose

The purpose of this document is to provide a summary of technical specifications for designing, manufacturing qualifying the High Voltage Signal Conditioner and Remote Input Output (HVSC&RIO) prototype required for implementing the ITER Magnet quench detection system. This summary of specifications will be used in scope of a call of nomination for a contract call for tender expected to be placed by end of the year 2016.

The outputs of this contract will be part of the inputs used for specifying the final version of the HVSC&RIO to be produced and installed on the Magnet systems for commissioning and plasma operation. The series production of the final version of the HVSC&RIO will lead to another and separate call for tender.

2 Background

A Quench Detection System (QDS) will be installed in order to protect the ITER superconducting magnets and feeder systems. The purpose of the QDS is to detect quenches in superconducting elements in order to activate the appropriate protection systems. The baseline design requires the ITER Magnet QDS is made of a primary QDS and a secondary QDS acting as a backup of the primary. The primary QDS is based on electrical measurements while the secondary QDS is based on thermos-hydraulic measurements.

This primary QDS will be composed of High Voltage (HV) measurements chains linked to an Electronic Quench Detection Device (EQDD). The scope of the contract is to contribute to the design of the primary QDS by focusing on the most critical part of it: the High Voltage Signal Conditioner and Remote IO (HVSC&RIO).

The basic function of the QDS is to measure the voltage drops signal on the superconducting elements, to compensate the inductive signal in order to extract the resistive signal, to filter the noise, to distinguish the Quench and to transmit a protecting action trigger signal to the right actuator through the ITER Central Interlock System (CIS) in order to avoid the Magnet systems permanent damage. The QDS also transmits a copy of all data (signal value, state and health monitoring data) involved in the EQDD functions to the Control and Data Acquisitions (CODAC) for further post event analysis.

The High Voltage Signal Conditioning & Remote Input Output (HVSC&RIO) is the signal front end and a link to the EQDD. It converts & transmits the voltage signals in the HV potential to voltage data in order to enable the digital signal processing in the EQDD.

Further details can be found out from the DDD11-9: Instrumentation (2F2B53 v4.0)

3 Scope of work

The scope of work is split in two phases: the first phase is allocated to the HVSC&RIO prototype design, the second allocated to the HVSC&RIO prototype manufacture and qualification:

Phase 1: Design

- ✓ The target is to get a base design for manufacture of all components of the HVSC&RIO prototype. This phase will be the opportunity to select the design options and clarify the technical points if any. The design materials (drawings, detailed design document) shall be reviewed and approved by IO before moving to the prototype manufacture. There is a holding point there to the contract for moving to the contract phase 2 cleared after the design approval by IO.
- ✓ The deliverables of this phase are typically circuit design diagrams, printed circuit board file, bills of materials, analysis of fault conditions, qualification plan….

Phase 2: manufacture and qualification

- ✓ Prototype manufacture: A set of prototypes of the HVSC&RIO will be manufactured after agreement on the manufacture Quality Plan (QP) and the Manufacture Inspection Plan (MIP).
- ✓ Software development: This device requires a few software, firmware and HDL. All this code shall be programmed by the contractor and verified by a certified software validation tools.
- ✓ Qualification tests: The components of this HVSC&RIO prototype will be tested and qualified by the Contractor at nominal performance for testing purpose and acceptance by IO. In addition to the tests performed by the Contractor, the compliance to High Voltage (HV) requirements will be tested by IO in IO test facilities.
- ✓ The HVSC&RIO device shall be shipped to IO for that testing purpose. In case the prototype device does not satisfy the contract requirements, corrective actions shall be carried out by the Contractor until all the qualification tests are successfully finished.
- ✓ Final prototype design for manufacture: The HVSC&RIO prototype design will be updated if required depending on the qualification tests results to get the final design for series production. The manufacture Quality Plan (QP) and Manufacture Inspection Plan (MIP) are updated accordingly if required.
- ✓ The deliverables in scope of this phase are typically the final versions of the design materials, hardware components as electronics boards, power supplies, computer host, optical links and software as system and application software….

4 Experience requirements

The contractor and its personnel shall have adequate experience in High Voltage signal conditioning development and manufacturing encompassing:

- ✓ R&D in HV analogue circuits over 20kV AC
- ✓ Design and manufacture of HV circuit over 20kV AC.
- ✓ Experience in Power Electronics over then more than 10 year.
- ✓ Experience in Fibre-Optic data communication.
- ✓ Be able to proceed to HV tests over 20kV AC & 56kV DC.
- ✓ Experience in HV insulations would be an advantage.
- ✓ Experience in Superconducting Magnets would be an advantage.

5 Award of contract

From ITER Organization rules, the contractor awarded for any component development phase cannot participate to the component series production phase. **As a consequence, the company awarded of this contract cannot participate to the HVSC&RIO series production contract**.

The language in use in ITER is English. A fluent professional level is required (spoken and written)

6 Candidature – Expression of Interest

Participation is open to all legal persons participating either individually or in a grouping (consortium) which is established in an ITER Member State. A legal person cannot participate individually or as a consortium partner in more than one application or tender. A consortium may be 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 pre-qualification stage. The tenderer's composition cannot be modified without the approval of the ITER Organization after the pre-qualification.

Legal entities belonging to the same legal grouping are allowed to participate separately if they are able to demonstrate independent technical and financial capacities. Candidates (individual or consortium) must comply with the selection criteria. The IO reserves the right to disregard duplicated reference projects and may exclude such legal entities from the pre-qualification procedure.

7 Time table for the Tender Process

The tentative schedule for this tender process is as follows:

Call for Nomination	May 2016
Pre-Qualification	June-July 2016
Call for Tender	August-September 2016
Tenders Submission	October-November 2016
Award of Contract	December 2016-January 2017