

**CONTRACT TECHNICAL SPECIFICATION**

**Engineering Support in the Areas of Vacuum  
and Cryogenics for the ITER Magnet Feeders  
and the ITER Vacuum System**

**Technical Specification  
Rev. 1.2**

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### Revision history

Date	Rev.	Note
07 Feb 2011	1.2	Final (minor) revisions prior to launch
02 Feb 2011	1.1	Incorporated revisions from vacuum section
08 Nov 2010	1.0	First issue

## 1 Abstract

This technical specification describes engineering work and manufacturing monitoring for the Feeders of the ITER Magnets System and support of the vacuum group on the domain of vacuum, cryopumps and cryodistribution.

Feeder System provides not only electric current to the coils, but also Supercritical Helium (SHE), instrumentation, etc.. The Feeder Final Design Review (FDR) took place in September 2010. The Feeder PA will be agreed with Chinese Domestic Agency (CNDA) in the coming weeks. The Institute of Plasma Physics of the Chinese Academy of Sciences (ASIPP) is responsible for manufacturing the Feeder System in Hefei, China.

The scope of this contract is to provide engineering and technical support services for

- The design, specification, and procurement follow-up of the Magnet Feeders, specifically in the areas of vacuum and cryogenics.
- Support the vacuum group for the design optimization of the cryodistribution system of the cryopumps and the follow up of the cryopumps prototype in collaboration with ITER subcontractors and partners.

The work will be 50-50 share between the Magnet Division and the Vacuum Group.

## 2 Background and Objectives

ITER superconducting magnet system consists of 18 TF coils, 6 PF coils, a Center Solenoid (CS), 18 Correction Coils (CC) and a Feeder System.

Feeder System provides not only electric current to the coils, but also Supercritical Helium (SHE), instrumentation, etc. Flexibility is required to accommodate the relative displacement during and after cool down, and of course mechanical and dielectric strengths are required against electromagnetic forces and high voltages, respectively. The Feeders (31 in total) are an integral part of the Magnet System and represent a challenge in terms of design, fabrication, and assembly. As they represent the bridge between the Magnet System and its ancillary and supply systems, the Feeders also constitute a major portion of all interface definitions between Magnets (PBS 11) and the rest of the machine.

The Feeder Final Design Review (FDR) took place in September 2010. The Feeder PA will be agreed with Chinese Domestic Agency (CNDA) in the coming weeks, therefore intensive activity is going on at present to resolve all issues raised at the FDR, complete interface definitions, and finalize all models and 2D drawings needed to launch the procurement. The Institute of Plasma Physics of the Chinese Academy of Sciences (ASIPP) is responsible for manufacturing the Feeder System in Hefei, China.

The objective of this contract is support the execution of the above mentioned Feeder PA in terms of engineering reviews, design changes, interface definition and specification, and production monitoring. Further, the objective of the contract is to provide technical support as mentioned above, specifically in the areas of vacuum technology and cryogenics.

## 3 Work Description

The work required in this technical specification includes engineering activities and monitoring manufacture in relation with the Feeders of the ITER Magnet System.

The scope of work described below is expected to entail a time commitment of 50% over the contract duration on the part of the expert.

Work is organized over two a two-year period, with specific tasks and deliverables defined on a quarterly basis.

The reference documents are appended at the end of this specification and their references listed here after.

DDD11-6: Feeders, CTBs, and Current Leads (ITER\_D\_2NMSYG v. 2.4)

### **Scope of work:**

This section describes the scope of work to be performed under the present contract.

Since the contract is for engineering services, technical support, and provision of expertise in the procurement activities related to the Feeders and cryopumps, the exact tasks will be agreed upon between IO and the expert (or company providing the expertise) on a quarterly basis. At the beginning of each three-month period, and based on the priorities of IO and the Feeder procurement, a work plan will be agreed upon, including deliverables for the period.

The overall scope includes:

#### **1 - Concerning feeders**

- Provide engineering services, technical support, and expertise in the design and specification of the Feeders for the ITER Magnets System, specifically in the areas of cryogenic pipes, manifolds and valves; vacuum ports and valves; vacuum barrier and electrical insulation implementation; and mechanical supports and thermal shields;
- Support efforts to produce drawings and diagrams related to the Feeder System, specifically piping and flow diagrams (PFD), and piping and instrumentation diagrams (PID). Support the production of, and produce, the corresponding design documentation.
- Define and maintain documentation related to Feeder interfaces with the Vacuum and Cryogenic Systems
- Define designs, qualification program, and assembly procedures for the vacuum and cryogenic components of the Feeder System
- Review the procurement specifications, provide modification when needed and support the process of introducing such deviations
- Support the implementation of the quality plan, implement the quality control plan in the areas of vacuum and cryogenic components for the Feeder System
- Contribute to the monitoring of the Feeder PA with the CNDA and with the quality control program through regular visits to the supplier

#### **2 - Concerning cryopumps**

- Optimization of design, layout and integration of the torus, cryostat, neutral beam and roughing cryogenic pumps and supplying cold valve boxes, including interface with cryoplant and cryodistribution system.
- Development of the control and operational schemes for the ITER vacuum pumping system, Including definition of operational interfaces.
- Development of documentation required for design reviews and procurement arrangements.
- Following of industrial contract for prototype and preproduction assemblies in collaboration with ITER collaborators
- Organisation of reviews and workshops as required by the work program.
- Work in other area as appropriately assigned by the ITER vacuum section leader.
- Advising and training of other vacuum staff either responsible or involved with the above work.

## **4 Duration**

The contract duration shall be two years. The IO may exercise the option to terminate the contract at the conclusion of the first year based on performance and results. The IO may exercise the option to extend these services for a maximum of one additional period of one year beyond the original contract. ITER Organization shall establish the request for services on ad hoc basis and relative to the respective annual work plan, with specific tasks and deliverables defined on a quarterly basis.

## **5 Deliverables and Time Schedule**

The specific work to be carried out as part of the two-phase approach given above is to be established quarterly (every three months). The IO will, in mutual agreement with the expert, establish tasks and priorities, along with the written reports to be produced, documentation to be reviewed, or travel needed to monitor supplier progress. These will be part of a work plan for the three-month period. Specific deliverables are:

- Final design reports, reports on reviewed documents, interface documentation, or any other written report as specified in the work plan
- Monthly reports with a summary of activities during the reporting period, including approximate time spent on each activity
- Trip reports each time there is a visit to a supplier to follow up or inspect work

## **6 Acceptance Criteria (including rules and criteria)**

The acceptance of the work is based on completion of the tasks and goals set on the work plan for each trimester, as well as on the completion of reports and documents specified in the work plan.

## **7 Payment schedule / Cost and delivery time breakdown**

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 the following areas:

- At least 30 years of experience in the areas of vacuum and cryogenics with an emphasis on superconducting, cryopump, and fusion applications
- Experience in the design, specification, and implementation of fluid transfer and cryodistribution systems. Experience with helium refrigeration/liquefaction facilities is also desirable.
- Experience with vacuum technology, vacuum pumps including cryopumps, and the integration of vacuum and cryogenic components (e.g., interface definition, design and specification).
- Experience in the installation and commissioning of vacuum and cryogenic equipment, especially large-scale devices, fusion-related devices, or superconducting systems
- Experience with instrumentation and control, especially in vacuum and cryogenic environments is desirable
- Ability to work in a team, yet be able to carry out tasks independently if needed
- Ability to communicate fluently and write reports in English
- Able to travel to follow up some of the feeder manufacturing (China)

Curriculum Vitae: CV showing evidence above is required.

## **9 Work conditions**

- Work plan for every three 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. Split it into parts for sharing is not acceptable.
- The contractor shall have its own office and computer resources. The contractor will be given access to the necessary data and documents either in paper or in computer files form at Cadarache ITER site. The contractor will also be allowed accessing to the necessary folders in the computer

server at Cadarache ITER site via internet. The contractor shall be given temporary office space in the premises of the Magnet Division and the Vacuum Group for the purposes of working onsite and hold meetings with Magnet Division and Vacuum Group personnel.

- The limits of visas for the accumulated period of stay in France and China are prior to the contract without penalty to the contractor in case of contradiction between the contract and the visas' requirements.

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## 10 Timetable

The tentative timetable is as follows:

Call for Expertise	February 2011
Tender submission	April 2011
Start of Contract	May 2011

## 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.