

**CONTRACT TECHNICAL SPECIFICATION**

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

**Technical Specification**

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## 1 Abstract

This technical specification describes engineering work and manufacturing monitoring for the Feeders of the ITER Magnets System.

Feeder System provides not only electric current to the coils, but also Supercritical Helium (SHE), instrumentation, etc. 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 cryogenics, vacuum, instrumentation and services.
- Support the vacuum section for the detailed design completion of the Front End Cryodistribution System of the cryopumps and the follow up of the cryopumps prototypes in collaboration with ITER DAs, subcontractors and partners.

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

## 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), control / monitoring signals, 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 Feeders manufacture is in progress now by the Chinese Domestic Agency (CNDA), therefore intensive activity is going on at present to resolve all issues, complete interface definitions, finalize all models and 2D drawings and design supporting services to feeders. 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 to support the execution of the above mentioned Feeder PA in terms of engineering reviews, design changes, interface definition and specification, and production monitoring, and to provide technical support in the areas of vacuum technology, cryogenics and instrumentation specifically related to the ITER feeder system.

## 3 Work Description

The work required in this technical specification includes engineering activities, instrumentation definition, feeder services and follow up of manufacturing in relation with the ITER Feeder System.

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

The reference documents are

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

[ITER\\_D\\_3PW67C - 1.1.P5A.CN.01 Annex B](#), v. 4.2

### **Scope of work:**

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

The contract is for engineering services, technical support, and provision of expertise in the procurement activities related to the Feeders. 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 the IO, a work plan will be agreed upon, including deliverables for the period.

The overall scope includes:

1) Feeders

- Provide engineering services, technical support, and expertise in the design and specification of the ITER Feeder System.
- Support efforts to produce drawings and diagrams related to the Feeder System.-
- Support the production of, and produce, the corresponding design documentation.
- Provide support for the feeder instrumentation.
- Provide design for engineering services necessary for the feeders operation.
- Provide expertise support in the design for feeders safety system related to cryogenic hazard.
- Define and maintain documentation related to Feeder interfaces with the Vacuum and Cryogenic Systems
- Define designs and qualification program, and assembly procedures for the vacuum and cryogenic components of the Feeder System
- Review the procurement specifications, propose modification when needed and support the implementation of the change request.
- Support the implementation of PA quality plan in the areas of vacuum and cryogenic components for the Feeder System
- Contribute to the follow-up of the Feeder PA with the CNDA at contractors' premises.

2) Vacuum- Support for the completion of the detailed design of the Front End Cryodistribution System for torus, cryostat, and neutral beam and cryogenic pumps, including functional interface with cryoplant and physical and functional interface with its cryodistribution system.

- Support for the completion of the control and operational schemes of cooling and regeneration for the ITER vacuum pumping system, including definition of operational interfaces.
- Support in the development of documentation required for design reviews and procurement arrangements.
- Support in the organization and review of material for design reviews as required by the work program.

Support in the design of water traps for the ITER roughing system.

Support in reviewing designs documentation generated by US DA for the cryogenic viscous flow compressor (CVC).

Pre-conceptual design work for front end distribution systems required for the CVC so as to ensure compliance with building and other interfaces.

- 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 one year. 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 after each mission to CNDA supplier(s) to follow up or inspect Feeder PA task(s).

### 5.1 Management of Vacuum Work Plan

- The Vacuum quarterly work plans will be prepared at least one month before a new quarter commences.
- Work plans will be uploaded to IDM for review and approval by the Vacuum Section Leader.
- The work plans will precise deliverables (engineering documentation beyond the monthly reports).
- Work shall not start before approval of the work plan.

## 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 magnets, cryogenic pumping, cryogenic distribution systems, instrumentation, cryogenic safety and fusion devices.
- Experience in the design, specification, and implementation of fluid transfer and cryodistribution systems.
- Experience in supercritical helium state and helium refrigeration/liquefaction facilities is also desirable.
- Experience with vacuum technology.
- Experience in the installation and commissioning of vacuum and cryogenic equipment, especially large-scale devices, fusion-related devices, and superconducting systems

- Experience with instrumentation and control, especially in vacuum and cryogenic.
- 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 procurements and tests in Europe or China.

Curriculum Vitae showing evidence of the above-mentioned experiences is required.

## 9 Work conditions

- Work plan for every three months is established and agreed by IO.
- This contract shall be executed by one staff. Split it into parts for sharing is not acceptable.
- The contract staff will be present at the ITER site for the entire duration of this contract with the exception of off-site missions agreed with IO.
- 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 Magnet Division for the purposes of working onsite.
- The limits of visas for the accumulated period of stay in EU, and China are prior to the contract without penalty to the contractor in case of contradiction between the contract and the visas' requirements.

## 10 Timetable

The tentative timetable is as follows:

Call for Expertise	July 2013
Award of Contract	September 1, 2013

## 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.