

CONTRACT TECHNICAL SPECIFICATION

**Engineering Work and Monitoring Manufacture
of the TF Coils and Feeder System for ITER**

Technical Specification

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	<i>Name</i>	<i>Affiliation</i>
<i>Author</i>	K. Seo	TKM
<i>Reviewers</i>	F. Savary	TKM
<i>Approver</i>	N. Mitchell	TKM

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Revision history

Date	Rev.	Note
15 July 2010	Rev. 1.1	First revision following meeting with Park Jun Hyung, Philippe Mousset and Frederic Savary on the 9 th of July 2010
19 July 2010	Rev. 1.2	Second revision following meeting with Frederic Savary on the 15 th of July 2010
24 July 2010	Rev. 1.3	Third revision following meeting with Frederic Savary and Park Jun Hyung on the 23 rd of July 2010

1 Abstract

This technical specification describes engineering work and monitoring manufacture of the Toroidal Field (TF) Coils and the Feeder System for ITER.

Regarding the TF coils, a Procurement Arrangement (PA) has been agreed between IO and Japanese Domestic Agency (JADA) or European Union Domestic Agency (EUDA) in 2008. Manufacturing studies are now being carried out by both DA's. For example, manufacturing plans, drawings, manufacturing and inspection procedures are to be established for the production by JA industries in one year. On the other hand, the feeder PA will be agreed with CNDA in one year, therefore intensive design activity is needed at present.

For both TF coils and Feeder System, designs, manufacturing and inspections to ensure mechanical strength, Helium leak tight, high dielectrical strength are critical. In particular, for TF coil, to achieve challenging tolerances on Radial Plate, Winding and Assembling with Winding Pack and Coil Case through critical manufacturing processes. In addition, the interfaces between coils and feeders should be properly designed and controlled.

The scope of this contract is engineering work and monitoring of manufacturing activities regarding the above mentioned subjects.

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. The TF coil consists of 7 Double Pancakes (DP), which are Nb₃Sn conductor embedded Radial Plates (RP) to form a Winding Pack (WP), and a coil case made of ITER grade austenitic steel. Inter-Coil Structures, e.g. Poloidal Shear Keys, OIS, IOIS are used to assemble 18 TF coils toroidally and to ensure both mechanical strength and flexibility at the energization.

Feeder System provides not only electric current, e.g. 68 kA for TF coil, but also Supercritical Helium (SHE), instrumentation, etc. Flexibility is required to accommodate with the relative displacement during and after cool down, and of course mechanical and dielectric strengths are required against electromagnetic forces and high voltages, respectively.

Regarding the TF coils, Procurement Arrangement (PA) has been agreed between IO and JADA or EUDA in 2008. Manufacturing studies are being carried out, and manufacturing plans, drawings, manufacturing and inspection procedures are to be delivered in one year. EUDA and JADA are responsible for 10 and 9 TF coils, respectively. Regarding the TF Coil structure, JADA is responsible for and will provide the required number of structures to EUDA.

The feeder PA will be agreed with Chinese Domestic Agency (CNDA) in the coming year therefore intensive design activity is going on at present. The Institute of Plasma Physics of the Chinese Academy of Sciences (ASIPP) is responsible for the Feeder System in China. The design accommodated with displacement during and after cool down, electromagnetic force, seismic load, high voltages, etc. is necessary. Manufacturability and reparability are also taken in account.

The objective of this contract is to provide support for the oversight of the above mentioned PA's in terms of engineering reviews and production monitoring.

3 Work Description

The work required in this technical specification includes engineering activities and monitoring manufacture in relation with 1) the TF Coils and 2) the Feeder System of the ITER Magnet System.

3.1 Regarding the TF Coils

The work relating to the TF Coils shall be executed partly in Cadarache at the ITER site in France and partly in Japan at the Japanese Domestic Agency (JADA) and its contractors.

The overall time to be spent on the TF Coil activity shall be 50%, half of this time will be in Cadarache or at the European contractors and the other half in Japan.

Most of the technical information relating to the TF Coils and Structures is contained in the following documents that will be made available to the successful contractor.

TF Coil PA with JADA: 1.1P1B.JA.01_Annex_B (ITER_D_2EW37K v1.0)

TFC Structures PA with JADA: 1.1 P2B.JA.01 Annex B (ITER_D_2F3ZHQ v1.0)

DDD11-2: TF Coils and Structures (ITER_D_2MVZNX v2.2)

Scope of work:

- Procurement Arrangement monitoring at JADA in Naka;
- Monitoring manufacture at JA contractors in both Japan and Europe;
- Engineering activities and PA monitoring activities in Cadarache at the ITER site in France.

The above includes:

1. Review manufacturing and inspection procedures delivered by JADA originated from JADA's contractor Toshiba and its sub-contractors, e.g. KHI, IHI, Kind, Industeel, Daido;
2. Witness critical operations in agreement with JADA and following the recommendations and instructions from IO;
3. Review the 2D drawings and the 3D models including those of the built-to-print specification and the manufacturing drawings.

Where the access to the DA's contractors is organized by IO. In relation with both 1 and 2, carry out:

- The review of the manufacturing and inspection procedures. This shall cover first the processes qualification part of Phase II of the PA, meaning verifying that the deliverables satisfy the technical and quality requirements as stipulated in the PA documents, Annex A and Annex B. The following items are of particular interest: qualification of raw materials, welding and Non-Destructive Test (NDT) of RP, He inlets and coil cases, winding, heat treatment and turn insulation using polyimide, glass tapes and CE / Epoxy blend;
- The assessment of critical parameters during the manufacturing operations, e.g. length measurements of the conductor during winding, bending forces, winding speeds, degrees of freedom are examples of work to be performed.

The IO may organize specific inspection or testing by expert company upon recommendation of the contractor, if deemed necessary.

2D drawings and 3D models are generated either by the manufactures (for manufacturing drawings) or by IO.

- Review and criticize those from manufacturing and inspection process view points;
- For this activity, it is mandatory to have and operate CATIA viewer. At present, current environment is CATIA V5 SP5 with Virtual Private Network (VPN), which is provided by IO;
- Assistance by draftmen and CAD work needed for geometrical study will be provided by IO.

3.2 Regarding the Feeder System

The work relating to the feeders shall be executed partly in Cadarache at the ITER site in France, partly in China at the Chinese Domestic Agency (CNDA) and its contractors.

The overall time to be spent on the feeder activity shall be 50%, half of this time will be in Cadarache or in China and the other half in contractor's premises.

Most of the technical information relating to the Feeder system is contained in the following document that will be made available to the successful contractor.

Scope of work for the Feeder System:

- This includes reviewing the conceptual design made by IO and CNDA, i.e. 3D models and 2D drawings, structural analysis against load, boundary conditions and design criteria, integration scenario of site assembly, alignment study, including for the electrical insulation;
- Assessment of the TF Coil to In-Cryostat-Feeder (ICF) interfaces and of the TF ICF itself;
- Monitoring manufacture at CNDA or their contractors;
- Review the 2D drawings and the 3D models, and criticize those from manufacturing and inspection process view points;
- CAD work environment is the same as the one for TF Coil tasks.

The IO may organize specific inspection or testing by expert company upon recommendation of the contractor, if deemed necessary.

4 Duration

- The framework contract duration shall be one year. The IO may extend these services for a maximum of two additional periods. ITER Organization shall establish the request for services on ad hoc basis and relative to the respective annual work plan;
- Allocation of efforts and service areas for each task is as shown below.

Task name	His region	Asia	Europe
TFC (50%)	His own company (12.5%)	JADA and JA Manufacturers (12.5%)	IO and JA sub-contractors in Europe (25%)
Feeder (50%)	His own company (25%)	CNDA (12.5%)	IO (12.5%)

5 Deliverables and Time Schedule

- Feedback on visits to JADA and its contractors shall be provided in the form of monthly reports and more frequent telephone or video conferences, according to needs. The same applies for visits to CNDA and its contractors;
- List of documents reviewed, e.g. manufacturing and inspection procedures, 2D drawings and 3D models, analysis reports;
- Final report for both tasks described in Sections 3.1 and 3.2. Each final report can be a compilation of the intermediate reports, which will be submitted throughout the execution of the contract, attached with summary cover pages.

6 Acceptance Criteria (including rules and 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 3.

7 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 large-scale applied superconductivity (at least 15 years);
- Proven experience in design and manufacture of large superconducting magnets for fusion (at least 15 years);
- Proven experience in project management and production management (at least 15 years);
- Good knowledge of the international and Japanese domestic standards, e.g. JIS, JSME applicable to TF Coil and Structure manufacturing;
- Experience with CAD systems, in particular with CATIA V5 or its equivalent;
- Capability to work in Japanese language.

Curriculum Vitae, CV showing evidence above is required.

8 Work condition

- 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 one sole 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;
- 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 format at Cadarache ITER site. The contractor will be allowed to access the necessary folders in the computer server at Cadarache ITER site via internet;
- 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.

9 Timetable

The tentative timetable is as follows:

Call for Expertise	August 2010
The Contract Award	September 2010

10 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.