Annex II

Technical Specifications

Feeders and TF Coil

Structures Inspection Expertise

ITER_D_SQNAXV_v1.2

Table of Contents

1 Purpose

This technical specification describes specific engineering work related to the Toroidal Field Coil Structures (TFCS), and Feeders System for ITER.

2 Scope

ITER superconducting magnet system consists of 18 TF coils, 6 PF coils, a Center Solenoid (CS), 18 Correction Coils (CC) and a Feeder System. Each 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 (ILIS, IIS, OIS, IOIS) and PCCF components are used to assemble the 18 TF coils together at the ITER site.

The 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.

According to the TF Coil Structures PA agreed between IO and JADA In late 2008, JADA is responsible for and will provide the TF coil cases needed for the EUDA and JADA to make respectively 9 and 10 TF coils, and to IO the Inter-Coil Structures and PCCF components needed to assemble the 18 TF coils. To provide the TF Coil Structures JADA has placed 8 different contracts with 3 different main contractors.

The Feeders PA was agreed with Chinese Domestic Agency (CNDA) in early 2011. 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 aim 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 Definitions

For a complete list of ITER abbreviations see annex A of the present document.

4 References

N/A

5 Estimated Duration

The contract duration shall be 1 year

6 Work Description

The work required in this technical specification includes performing engineering reviews and production monitoring in relation with the TF Coil Structures (6.1) and the Feeder System (6.2) of the ITER Magnet.

6.1 TF Coil Structures (Tasks 1.1 & 1.2)

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

TFC Structures PA with JADA: 1.1 P2B.JA.01 Annex B (ITER_D_ 2FEGX8 v1.2)

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

Scope of work includes:

- Reviewing manufacturing and inspection documents;
- Monitoring manufacture at JA contractors in Japan and Korea;

6.1.1 Task 1.1 Review of Manufacturing Documents:

Review manufacturing and inspection documents (MPs, MDs, MIPs, procedures, reports) submitted to IO by JADA and originated from JADA's contractor MHI, HHI and Toshiba, and their sub-contractors, e.g. Kind, FAV, JCFC, Daido; Review the corresponding 2D drawings and the 3D models.

This means verifying that the deliverables satisfy the technical and quality requirements stipulated in the PA Annex B, including IO TFCS drawings and specifications. The following items are of particular interest: qualification of raw materials; welding, Non-Destructive Test (NDT) and machining of TF coil cases, Inter-Coil Structures and PCCF components; attachment and leak checking of cooling pipe. Up to a maximum of 160 documents will require review, assuming 2 documents per hour.

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

- Review 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;

6.1.2 Task 1.2 Monitoring of Manufacture:

On behalf of IO perform Intervention Points, witness critical operations and monitor quality of manufacture and documentation at JADA's contractor facilities in agreement with JADA and following the recommendations and instructions from IO. Access to JADA's contractors will be organized by JADA.

If deemed necessary, the contactor may recommend to IO specific inspection or testing by an expert company. If necessary the IO Responsible Officer may amend the purpose of the intervention point, the contractor will be advised in advance.

Sub-task	Details
1.2.1	• Report on visit to review manufacturing progress and documentation related to TFCS outboard sub-assemblies and intercoils structure components, including MIP intervention points, 3 days duration • Report on visit to review manufacturing progress and documentation related to TFCS outboard sub-assemblies and intercoils structure

	components including MIP intervention points, 3 days duration • Report on visit to review manufacturing progress and documentation related to TFCS outboard sub-assemblies and intercoils structure components including MIP intervention points, 3 days duration
1.2.2	• Report on visit to review manufacturing progress and documentation related to TFCS outboard sub-assemblies and intercoils structure components including MIP intervention points, 3 days duration • Report on visit to review manufacturing progress and documentation related to TFCS outboard sub-assemblies and intercoils structure components including MIP intervention points, 3 days duration • Report on visit to review manufacturing progress and documentation related to TFCS inboard sub-assemblies and intercoils structure components including MIP intervention points, 3 days duration
1.2.3	• Report on visit to review manufacturing progress and documentation related to TFCS outboard & inboard sub-assemblies and intercoils structure components including MIP intervention points, 3 days duration

6.2 Feeder System (Tasks 2.1 & 2.2)

The work relating to the feeders shall be executed partly at contractor's premises and partly in China at the Chinese Domestic Agency (CNDA) and its sub-contractors.

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.

DDD11-6: Feeders, CTBs and Current Leads (ITER_D_2NMSYG v1.3)

Scope of work includes:

- Review CNDA's MP, MIP, QA and welding documents and related procedures for component manufacturing;
- Review hold-point acceptance test report during component manufacturing and final manufacturing dossier of finished component for in-factory acceptance.
- Review interface and assembly drawings issued by IO;
- Assess Feeder internal and external interfaces, alignment study and tolerance mitigation.
- Attend Feeder component Manufacturing Readiness Assessment (MRA) meetings.
- Review Feeder integration scenario of site assembly including Assembly and Inspection Plan (AIP).
- Monitor component manufacturing and acceptance tests for qualification and production phases at CNDA or their subcontractors' premises;

The access to the DA's contractors is organized by IO as necessary.

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

6.2.1 Task 2.1 Feeder Document Review

Feeder Document Review on Component design, Qualification, Production, and In-factor / On-site Assembly and Inspection Plans.

Magnets Manufacture Database hierarchy:

- Review the hierarchy of MMD for Phase III production database upon IO specific request as IDM review

Manufacturing document review:

- Review DA's documents required for Manufacturing Readiness Assessment (MRA) for production phase as IDM review

Manufacture readiness review:

- Submit evaluation of MRA meeting in accordance with CNDA's schedule both upon IO specific request as IDM review

Production data document (PDD) review:

- Submit evaluation of DA's PDD meeting for Phase III upon IO specific request as MMD / IDM review.

Qualification report review:

- Submit evaluations of Phase II & III hold point tasks upon IO specific request as IDM report review.
- Review feeder in-factory acceptance dossier of finished component / shipping packaging upon IO specific request as IDM report review

6.2.2 Task 2.2 Perform Intervention Points

On behalf of IO perform Intervention Points, witness critical operations and monitor quality of manufacture and documentation at CNDA’s contractor facilities in agreement with CNDA and following the recommendations and instructions from IO. Access to CNDA’s contractors will be organized by CNDA. Each visit/attendance for an expected duration of 4 days on site.

If deemed necessary, the contactor may recommend to IO specific inspection or testing by an expert company. If necessary the IO Responsible Officer may amend the purpose of the intervention point, the contractor will be advised in advance.

Sub-task	Details
2.2.1	Attend CTB, SCVB box / thermal shield MRA; Shanghai/Hefei, China
2.2.2	Visit to KY on PF4 CFT subassembly acceptance 1; Hefei, China Visit to HX on CFT TS acceptance; Shanghai, China Visit to ASIPP on feeder joint insulation; Hefei, China

2.2.3	Attend HTSCL MRA; Hefei, China Visit to KY on PF4 CFT subassembly acceptance 2; Hefei, China Visit to ASIPP on CL + S_bend insulation fatigue test 1; Hefei, China
2.2.4	Visit to ASIPP on CL + S_bend insulation fatigue test 2; Hefei, China Attend CTB internal / integration MRA; Hefei, China
2.2.5	Visit to KY on PF4 CFT subassembly acceptance 3; Hefei, China
2.2.6	Attend all CFT except PF4 CFT MRA; Hefei, China Visit to KY on PF4 CFT acceptance; Hefei, China
2.2.7	Visit to KY on PF4 CFT packaging; Hefei, China
2.2.8	Attend CC ICF MRA; Hefei, China
2.2.9	Visit to SH on PF4 CTB cryostat / thermal shield acceptance; Shanghai, China

7 Responsibilities

N/A

8 List of deliverables and due dates

Deliverable Ref.	Deliverable Description	Estimated Due Date
Del 1.1.1	Report on task 1.1	T0 + 12 mths
Del 1.2.1	Report on sub-task 1.2.1	T0 + 2 mths
Del 1.2.2	Report on sub-task 1.2.2	T0 + 4 mths
Del 1.2.3	Report on sub-task 1.2.3	T0 + 6 mths
Del 2.1.1	Report of task 2.1	T0 + 12 mths
Del 2.2.1	Report on sub-task 2.2.1	T0 + 2 mths
Del 2.2.2	Report on sub-task 2.2.2	T0 + 3 mths
Del 2.2.3	Report on sub-task 2.2.3	T0 + 4mths
Del 2.2.4	Report on sub-task 2.2.4	T0 + 5 mths
Del 2.2.5	Report on sub-task 2.2.5	T0 + 6 mths
Del 2.2.6	Report on sub-task 2.2.6	T0 + 7 mths
Del 2.2.7	Report on sub-task 2.2.7	T0 + 8 mths
Del 2.2.8	Report on sub-task 2.2.8	T0 + 10 mths
Del 2.2.9	Report on sub-task 2.2.9	T0 + 12 mths

9 Acceptance Criteria

Deliverables are submitted by way of pdf report, Approved by the IO RO.

10 Specific requirements and conditions

The contractor will be given access to the necessary data and documents either in paper or in computer files format at ITER site. The contractor will be allowed to access the necessary folders in the computer server at ITER site via internet;

Any cost related to Contractor travel (flights, local transport, renewal and acquisition of visas, hotel, meals etc. shall be paid by the Contractor.

The supplier accepts that information received from or derived from access to manufacturer premises or documentation is to be treated as strictly confidential. No information shall be shared with any other manufacturer.

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 proposed by the bidder to carry out the work described in Section 5 must have proven experience in following areas:

- Proven experience in large-scale applied superconductivity (at least 15 years);
- Proven experience in design, manufacture, and assembly of large superconducting magnets for fusion (at least 15 years);
- Proven experience in project management and production management (at least 15 years);
- Proven record of in-situ troubleshooting and problem-solving in a large component manufacturing / assembly workshop;
- Good knowledge of the international and Japanese domestic standards, e.g. JIS, JSME applicable to TF Coil Structures manufacturing, and EN, ISO, ASTM applicable to Feeder manufacturing / acceptance tests
- Capability to work in English and Japanese languages.

11 Work Monitoring / Meeting Schedule

- A work plan shall be established and agreed by IO every three months;
- Given the fact suppliers hold trade secrets in the manufacture of Iter Magnet and Feeder System and some of their components, and that competitive considerations are at play, the expert is expected to disclose any and all conflicts of interest in the conduct of this contract, and sign non-disclosure agreements as directed by the IO.
- Invoices will be raised and paid based on accepted deliverables (section 8).
- Payment shall be executed only if the contractor has fulfilled his contractual obligations by the date on which the invoice is submitted.

12 Quality Assurance (QA) requirements

The organisation conducting these activities should have an ITER approved QA Program or an ISO 9001 accredited quality system.

The general requirements are detailed in ITER Procurement Quality Requirements (ITER_D_22MFG4).

Prior to commencement of the task, a Quality Plan must be submitted for IO approval giving evidence of the above and describing the organisation for this task; the skill of workers involved in the study; any anticipated sub-contractors; and giving details of who will be the independent checker of the activities (see Procurement Requirements for Producing a Quality Plan (ITER_D_22MFMW)).

Documentation developed as the result of this task shall be retained by the performer of the task or the DA organization for a minimum of 5 years and then may be discarded at the direction of the IO. The use of computer software to perform a safety basis task activity such as

analysis and/or modelling, etc. shall be reviewed and approved by the IO prior to its use, in accordance with Quality Assurance for ITER Safety Codes (ITER_D_258LKL).

13 CAD Design Requirements (if applicable)

N/A

14 Safety requirements

ITER is a Nuclear Facility identified in France by the number-INB-174 ("Installation Nucléaire de Base").

For Protection Important Components and in particular Safety Important Class components (SIC), the French Nuclear Regulation must be observed, in application of the Article 14 of the ITER Agreement.

In such case the Suppliers and Subcontractors must be informed that:

- The Order 7th February 2012 applies to all the components important for the protection (PIC) and the activities important for the protection (PIA).
- The compliance with the INB-order must be demonstrated in the chain of external contractors.
- In application of article II.2.5.4 of the Order 7th February 2012, contracted activities for supervision purposes are also subject to a supervision done by the Nuclear Operator.

For the Protection Important Components, structures and systems of the nuclear facility, and Protection Important Activities the contractor shall ensure that a specific management system is implemented for his own activities and for the activities done by any Supplier and Subcontractor following the requirements of the Order 7th February 2012 [20].