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# 1 Purpose

This Specification is for the services of one Senior Mechanical Engineer and one 4D Planning Engineer to provide engineering support to the machine assembly program of the ITER Organization in the preparation for the assembly of nuclear and non-nuclear components of the ITER Tokamak on Worksite 1, including but not limited to the Assembly Hall (Building 13), Tokamak pit (Building 11) and the Cleaning Facility (Building 17).

## 2 Scope

### 2.1 Overview

The ITER Organization (IO) is actively managing the execution of the construction works for the ITER Tokamak on Worksite 1.

The machine assembly program requires Engineering and 4D Planning support, to assist IO with optimisation of use of the limited available space and crane capacity for construction activities and assessment of assembly sequences. This includes:

- Building and maintaining Synchro 4D models, identifying and modelling optimisations and alternative approaches;
- Technical support to construction planning and coordination by developing, modelling and analysing baseline and alternative scenario, including comparison of options using Primavera P6;
- Creation of analysis reports for construction sequences, providing justified proposals for improvement and identification of opportunities/risks.
- Preparation and / or update of assembly procedures and related documentation;
- Contribution to preparation, review and compilation of the engineering and existing data for construction and / or for the specification and procurement of purpose-built tools;
- Monitoring/tracking of progression/closure of assembly feasibility issues;
- Provision of the requisite engineering and technical support in order to assist preparation of documentation for construction;

All work shall be output and recorded as Deliverables, comprising documents submitted by the Contractor for IO approval, in the format agreed based on information availability and the specific purpose/scope of the Deliverable requested.

In the event that sufficient input information is not available, or as a consequence of reprioritisation of scope, substitution of Deliverables may be agreed; with any changes regarding content, timing, or format of Deliverables being recorded on Monthly Progress Meeting minutes, signed by both the Contractor Responsible (C-R) and the IO technical Responsible Officer (TRO)

## 3 Definitions

Abbreviation	Definition
C-R	Contractor Responsible Officer
CAD	Computer Aided Design
CD	Current Drive
CHWS	Chilled Water System
CCWS	Component Cooling Water System(s)
CMA	Construction Manager as Agent
CODAC	Control, Data Access and Communication

Abbreviation	Definition
CST	Construction Department
CWP	Construction Work Package
DA	Domestic Agency
DCIF	Design Collaboration Implementation Form
DO	Design Office (IO)
ECH	Electron Cyclotron Heating
EWP	Engineering Work Package
H & CD	Heating and Current Drive
I2P	Instruction to Proceed
ICH	Ion Cyclotron Heating
IDM	ITER Document Management (system)
INB	Installation Nucléaire de Base
IO	ITER Organization
IV	In-Vessel
MAP	Machine Assembly Program
NB	Neutral Beam
PBS	Plant Breakdown Structure
PIA	Protection Important Activity
PIC	Protection Important Component
PRO	Procurement Responsible Officer
QA	Quality Assurance
RF	Radio Frequency
RO	Responsible Officer (IO)
SIC	Safety Important Class
SQEP	Suitably Qualified and Experienced Personnel
TRO	Task Responsible Officer (IO)
VVPSS	Vacuum Vessel Pressure Suppression System
WBS	Work Breakdown Structure

For a complete list of ITER abbreviations see: [ITER Abbreviations \(2MU6W5\)](#).

## 4 References

- [1] [Work Breakdown Structure for Site Construction Phase I \(QPY7MQ\)](#) [latest version]
- [2] [Internal Regulations \(27WDZW v2.2\)](#)
- [3] [In-Cash Procurement Technical and Management Documentation Exchange and Storage Working Instruction \(G8UMB3 v3.0\)](#)
- [4] [ITER Procurement Quality Requirements \(22MFG4 v5.0\)](#)
- [5] [Requirements for Producing a Quality Plan \(22MFMW v4.0\)](#)
- [6] [Quality Assurance for ITER Safety Codes Procedure \(258LKL v2.2\)](#)
- [7] [Procedure for the Usage of the ITER CAD Manual \(2F6FTX v1.1\)](#)
- [8] [Procedure for the CAD management plan \(2DWU2M v2.0\)](#)

- [9] [Specification for CAD data production in ITER Contracts \(P7Q3J7 v2.0\)](#)
- [10] [CAD Manual 07 - CAD Fact Sheet \(249WUL v4.0\)](#)
- [11] [Order dated 7 February 2012 relating to the general technical regulations applicable to INB - EN \(7M2YKF\)](#)
- [12] [PRELIMINARY ANALYSIS OF THE IMPACT OF THE INB ORDER - 7TH FEBRUARY 2012 \(AW6JSB v1.0\)](#)

## 5 Duration

The duration shall be for 24 months from the starting date, defined by the Contract.

## 6 Work Description

The Contractor's personnel will provide support to MAP mainly from off-site. However, due to the need for permanent liaison and discussion with IO and CMA and to access the IO worksite, periodic and frequent visit at IO Headquarters, Cadarache, France is considered, based upon agreement of the Technical Responsible Officer (TRO) and applicable IO regulation.

The Contractor shall assist with the coordination, planning, and preparation of documentation for the site assembly and installation activities being conducted in Worksite 1.

MAP requires support in the following general areas, where the Contractor shall provide:

- Use of 4D model to work in close collaboration with CMA work face planners to help develop feasible work-face plans.
- 3 months look ahead 4D planning: up-date every month for pit and assembly hall
- 1 year look ahead 4D planning: up-date every 2 months for pit and assembly hall
- Sector Sub-assembly Assembly tool (A2): Maintenance on a regular basis of the sector module assembly 4D planning
- Sector module assembly sequence in pit (A3): Development and maintenance on a regular basis of the 4D planning
- TF coil pre-compression and pit datum (A4): Development and maintenance on a regular basis of the 4D planning
- Ex-vessel assembly sequence (A5): Development and maintenance on a regular basis of the 4D planning
- In-vessel assembly sequence (A6): Development and maintenance on a regular basis of the 4D planning

For all studies, IO provides the Primavera 6 schedule. The critical analysis of this schedule need to be performed. Space or crane overbookings have to be highlighted and mitigation proposal to be proposed. Up-date of Primavera 6 schedules might be requested.

Summary of the crane and space booking is part of the deliverable for each 4D planning.

The A2, A3, A4, A5 and A6 assembly sequences are performed in parallel. The different 4D planning shall consider the constraints from the other assembly sequences.

In addition to the 4D scheduling support, MAP requires support in the following general areas:

- Assistance with the preparation of assembly feasibility studies, construction process descriptions as a basis for cost and schedule, Engineering Work Packages (EWPs) for contract;
- Provide tracking and resolution of technical issues arising during the preparation for assembly.

- Creation of 4D analysis reports for construction sequences, providing suggestions for improvement and identification of opportunities/risks

The Senior Mechanical Engineer and the Planning Engineer shall work closely with the WS1 management team.

## 7 Responsibilities

### 7.1 IO Responsibilities

The IO shall appoint a TRO for the Contract, who will be the point of contact for all technical matters, and a Procurement Responsible Officer (PRO) for all contractual and commercial matters. The TRO shall organise a Monthly Meeting with the Contractor on work performed.

In addition, IO shall provide:

- Office accommodation permanent access to site;
- Computing facilities and ITER laptops, access to IDM and software required to fulfil specified functions;
- Component CAD models or access to the CAD models in ENOVIA / CATIA;
- Access to requirements documents, presentations and other information explaining installation concepts on which current schedules are based (where available);
- Access to IO design and design review information and reports as available/requested;
- Access to construction site;
- Any input information needed by the Contractor for production of the various Deliverables.

### 7.2 Contractor Responsibilities

The Contractor shall:

- Appoint a TRO for the Contract, who will be the point of contact for all technical matters, and a C-R for all matters related to this Contract;
- Appoint an operational point of contact for the management of the Deliverables;
- Provide suitably experienced and trained Engineers to complete all aspects of Deliverables and associated documentation;
- Strictly implement the IO procedures, instructions and use IO templates, where provided;
- Organise work in an efficient way according to the workload and monthly commitments and objectives;
- Report to the TRO any issues during the performance of the Contract which require IO intervention or decision including potential delays in the submission of Deliverables;
- Provide monthly reports, minutes of meetings, records of decisions and other Deliverables as required in section 8;

Contractor's personnel shall be bound by the rules and regulations governing the IO ethics, safety and security – refer [2] [Internal Regulations \(27WDZW v2.2\)](#).

## 8 List of Deliverables and Due Dates

The deliverables for this task are:

- Minutes of monthly progress meetings, to be submitted 1 day after the monthly progress meeting. *The kick-off meeting shall be considered as the first monthly progress meeting.*
- Monthly progress reports describing the work done on activities mentioned in 6.1 or alternatives as agreed in advance in writing by TRO.

The monthly report shall:

- Be submitted monthly, starting one month after the kick-off of the contract.
- Summarise the activities completed in the month concerned including:
  - **4D Planning;**
  - **Engineering Work Packages:** Inputs to Engineering Work Packages and assembly studies;
  - **Issue tracking:** new issues identified, actions taken, issues closed;
  - **Recommendations & Reports:** recommendations or reports.
- Include IDM references of documents reviewed/produced;
- Highlight specific issues requiring further action / summarise improvement opportunities;

In addition, the following deliverables need to be provided. For 4D plannings, a summary presentation and the native Synchro file need to be up-loaded in IDM.

3 months look ahead 4D planning: up-date every month for pit and assembly hall	Every month
1 year look ahead 4D planning: up-date every 2 months for pit and assembly hall	Every 2 months
Sector Sub-assembly Assembly tool (A2): Maintenance on a regular basis of the sector module assembly 4D planning	Every 3 months
Sector module assembly sequence in pit (A3): Development and maintenance on a regular basis of the 4D planning	Every 3 months
TF coil pre-compression and pit datum (A4): Development and maintenance on a regular basis of the 4D planning	Every 3 months
Ex-vessel assembly sequence (A5): Development and maintenance on a regular basis of the 4D planning	Every 3 months
In-vessel assembly sequence (A6): Development and maintenance on a regular basis of the 4D planning	Every 3 months
Assembly feasibility studies summary report	Every 3 months

In addition to these formal deliverables, the contractor will have to provide intermediate reports necessary to support meetings and discussion related to the above topics.

## 9 Deliverables Acceptance Criteria

Deliverables shall be submitted in accordance with [3] [In-Cash Procurement Technical and Management Documentation Exchange and Storage Working Instruction \(G8UMB3 v3.0\)](#)

The following criteria shall be the basis of the acceptance of the successful accomplishment of the work.

### Delivery Date Criteria

On-time delivery of Deliverables according to the dates provisionally defined in Section 8.

### Report and Document Review Criteria

Reports and Deliverables shall be stored in the ITER Organization's document management system, IDM, by the Contractor for acceptance. A named ITER Organization's TRO is the Approver of the delivered documents. The Approver can nominate or delegate one or more Reviewers(s) in the area of the Deliverable's expertise. The Reviewer(s) may ask for modifications to be made to the report in which case the Contractor must submit a new version.

The acceptance by the Approver is an acceptance criterion for completion of a Deliverable.

## 10 Specific Requirements and Conditions

The work will require qualified Engineers with suitable proven technical skills commensurate with the work scope of this Specification. It is the responsibility of the Contractor to ensure that work is performed by Suitably Qualified and Experienced Personnel (SQEP) and the suitability of Contractor resources shall be demonstrated by the Contractor in any proposals.

The following general requirements are applicable:

- The working language of the project is English, and all contributors are expected to be able to communicate clearly and effectively – both orally and in writing;
- Experience in international projects;
- Proficient command of the Microsoft Office packages;
- Experience in Tender package compilation and procurement;
- Prior knowledge of and experience on the ITER project.

The following specific requirements apply for respective resources:

### Senior Mechanical Engineer

- Bachelor's degree or higher in Mechanical Engineering;
- At least 5 years' professional experience of the assembly of tokamaks, or similar experience involving large and heavy components, precision alignment, ultra-high vacuum and clean conditions;
- At least 5 years' of professional experience in 4D planning, including the development and use of Synchro models, using input data from Primavera and 3D models;
- At least 5 years' experience using CATIA V5 to create and manipulate 3D models, and ENOVIA for storage/data management of 3D models;
- Proven ability to autonomously conduct assembly studies, identify improvements, resolve issues, and produce clear documentation;
- Prior knowledge of the ITER tokamak assembly would be an advantage.

### Senior 4D Planning Engineer

- Bachelor's Degree or higher in a technical subject;

- At least 5 years' project management experience;
- At least 5 years' of professional experience in 4D planning, including the development and use of Synchro models, using input data from Primavera and 3D models and related data management / version control;
- At least 5 years' scheduling/planning experience using Primavera;
- At least 2 years' professional experience of the assembly of tokamaks, or similar experience involving large and heavy components, precision alignment, ultra-high vacuum and clean conditions; Working knowledge and experience using 3D CAD software;
- Proven ability to identify possible improvements, conduct related analyses and create reports based on 4D Simulations suitable for use by IO Senior Management for decision-making;
- Prior knowledge of the ITER tokamak assembly would be an advantage.

## **11 Work Monitoring / Meeting Schedule**

### **11.1 Kick-off Meeting**

A Kick-off Meeting shall be arranged by the TRO approximately one week after the commencement of the Contract for the purpose of confirming background documentation, plans, schedules, and design data defining the work. All of the resources appointed at that time, plus the C-R (if separate), shall be required to attend.

The record of Kick-off Meeting minutes shall be submitted by the Contractor as a Deliverable.

### **11.2 Progress Reporting**

Personnel in charge of preparing the Deliverables will be expected to attend Monthly Progress Meetings.

Monthly Progress Meetings will be arranged by the TRO.

The main purpose of the Progress Meetings between the ITER Organization/CST Department and the Contractor is to:

- Review the completed activities and assess the progress made;
- Permit fast and consensual resolution of unexpected problems;
- Agree the specific tasks and corresponding deliverables to be completed in the month ahead;
- Review the technical issues and opportunities
- Clarify doubts and prevent misinterpretations of the technical specifications.

The record of Progress Meeting minutes shall be submitted by the Contractor as Deliverables.

## **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 [4] [ITER Procurement Quality Requirements \(22MFG4 v5.0\)](#).

Prior to commencement of the Contract, a Quality Plan (where applicable) must be submitted for IO approval giving evidence of the above and describing the organisation for the Contract; the skill and experience of workers involved in the study; any anticipated sub-contractors; and giving details of who will be the independent checker of the activities, if required - see [5] [Requirements for Producing a Quality Plan \(22MFMW v4.0\)](#).

Alternatively the contractor may opt to follow the IO QA processes. In this case, the requirement to prepare a Quality Plan is not applicable. Specific training shall be provided by IO.

Documentation developed as the result of this Contract shall be retained by the Contractor 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 activity such as analysis and/or modelling, etc. shall be reviewed and approved by the IO prior to its use, in accordance with [6] [Quality Assurance for ITER Safety Codes Procedure \(258LKL v2.2\)](#).

### 13 CAD Design Requirements

The Contractor shall ensure that all designs, CAD data and drawings delivered to IO comply with the [7] [Procedure for the Usage of the ITER CAD Manual \(2F6FTX v1.1\)](#), and with the [8] [Procedure for the CAD management plan \(2DWU2M v2.0\)](#).

The reference scheme is for the Contractor to work in a fully synchronous manner on the ITER CAD platform (see detailed information about synchronous collaboration in the ITER [9] [Specification for CAD data production in ITER Contracts \(P7Q3J7 v2.0\)](#)).

This implies the usage of the CAD software versions as indicated in [10] [CAD Manual 07 - CAD Fact Sheet \(249WUL v4.0\)](#) and the connection to one of the ITER project CAD data-bases. Any deviation against this requirement shall be defined in a Design Collaboration Implementation Form (DCIF) prepared and approved by DO and included in the call-for-tender package. Any cost or labour resulting from a deviation or non-conformance of the Supplier with regards to the CAD collaboration requirement shall be incurred by the Contractor.

### 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 Sub-contractors 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) – refer [11] [Order dated 7 February 2012 relating to the general technical regulations applicable to INB - EN \(7M2YKF\)](#).
- 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 Sub-contractor

following the requirements of the Order 7th February 2012 [12] [PRELIMINARY ANALYSIS OF THE IMPACT OF THE INB ORDER - 7TH FEBRUARY 2012 \(AW6JSB v1.0\)](#).

## **15 Copyright**

The deliverables and any products developed under this contract remain ITER Organisation exclusive property.

The Contractor shall not make any use of such products outside of the defined scope of this contract without IO prior formal agreement.