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Call For Tender Documents

Technical Summary for Sectors Modules in Pit Assembly works (SMPA)

Preliminary technical description of the scope of the SMPA contract issued to the market to check the interest and capabilities of potential tenderers

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Technical Summary for Sectors Modules in Pit Assembly (SMPA) contract

1 Purpose

The ITER Organization (IO) intends to issue a Tender procedure for the Sector Modules in Pit Assembly works (SMPA).

The information and technical details provided in the present document are preliminary and shared with the Candidates to check their interest and capabilities for this contract. Therefore the final technical specifications that will be issued during the Invitation to Tenderers (ITT) will be the only documents to be considered for biding.

2 Background

The ITER Organization (IO) is a joint international research and development project for which the initial construction activities are underway. The seven members of the IO are: the European Union (represented by Fusion For Energy (F4E)), Japan, the People's Republic of China, India, the Republic of Korea, the Russian Federation and the USA.

The project aims to demonstrate the scientific and technological feasibility of fusion power for peaceful purposes and to gain necessary data for the design, construction and operation of the first electricity-producing fusion plant. It will also test a number of key technologies, including the heating, control, diagnostic and remote maintenance that will be needed for a full-scale fusion power station.

The ITER site is in the Bouches du Rhône district of France. It includes the Headquarters of the IO and a construction worksite. The construction of the facility is on-going. Further information is available on the IO website: http://www.iter.org.

3 Tokamak assembly sequences

The overall assembly process of the Tokamak is sub-divided into six groups of assembly activities (Sequences) in addition to a 7th group (A7) including other pre-assembly activities.

Prior to the Sector Modules installation in the Tokamak Pit, the gravity supports, lower cryostat sections, and the components which cannot be installed following final assembly of the Sector Modules, principally the lower poloidal field coils, lower correction coils, the lower cryostat thermal shield parts, the lower and side correction coil feeders, and the lower pre-compression rings, have been installed or temporarily stored within the cryostat base (Assembly Sequence A1). In parallel, components of the feeders for the superconducting magnets have been installed in the lower-level gallery of the Tokamak Building and penetrating the bio shield wall and cryostat penetrations

The Tokamak is assembled from nine Sector Modules, each encompassing a toroidal angle of 40°, and comprising a 40° Vacuum Vessel sector (VV), two Toroidal Field Coils (TFC), a 40° Vacuum Vessel Thermal Shield sector (VVTS), and the associated interconnections and supports. The components are delivered to the site individually, and sub assembled into Sector Modules using purpose-built jigs and fixtures in the Assembly Building (Assembly Sequence A2).

The Sector Modules are then transferred to the Tokamak Pit sequentially where, following alignment, the TFCs are attached to their permanent supports and connected sequentially, the VVTS sectors are also connected sequentially, whereas the VV sectors are joined (welded) according to a plan which aims to minimize deformations, and the associated technical risk.

Following installation of the final Sector Module, the VV is closed toroidally. Some port stub extensions will be installed in the Upper region. (Assembly Sequence A3).

The permanent Vacuum Vessel Gravity Supports (VVGS) are positioned and attached to the VV and Cryostat. The TFC pre-compression rings are then installed, and the preload applied to each of the coils. A detailed dimensional survey at this stage provides the geometrical estimate of the magnetic datum for the as-built TF magnet, and this is used as reference for all subsequent alignment operations.

The major sector assembly tools are disengaged and removed from the Tokamak Pit to allow the subsequent assembly sequences to proceed (Assembly Sequence A4).

Internal VV access is via selected horizontal ports at the lower (divertor) and equatorial levels. Clean conditions are established inside the vessel, and the installation of the Phase 1 in-vessel systems is completed (Assembly Sequence A6).

The completion of the installation of the ex-vessel components proceeds, with completion of the Cryostat in parallel (Assembly Sequence A5).

The pre-assembly of some other major parts like the Central Solenoid (CS) and the Lower Cryostat Thermal Shield (LCTS) will be done in the Building 13 (Assembly Sequence A7).

This contract is mostly hosting assembly works of the Assembly Sequences A3 and A4 and is intended to be a firm prices contract covering preparation (documentation, tools, materials), training & qualification, execution and completion activities. At the start of the contract the Assembly Sequences A1 and A2 will be under completion.

4 Scope of work

The main scope of work of the contract is summarized as follow:

- Final alignment of the TFC pair and pre-alignment of the VV sector in the pit according to the requirements (required accuracy is within +/- 1mm for the TFC pair) defined by the IO reverse engineering group (figure 1),
- Landing of the TFC pair on the Toroidal Field Gravity Supports (TFGSs) at the outboard side including the required customization and installation of the TFGS shim plates (figure 2),
- Customization and installation of the additional shims and bolting between TFC and TFGS (figure 2),
- Assembly and connections of the in pit Intercoil Structures by performing the required metrology, local reverse engineering and shims customization (figure 3),
- Load transfer and final landing of the complete TFCs assembly onto the TFGS (figure 4),
- Removal of the Central Column and inner beams
- Assembly and tightening of the pre-compression rings (figure 5).

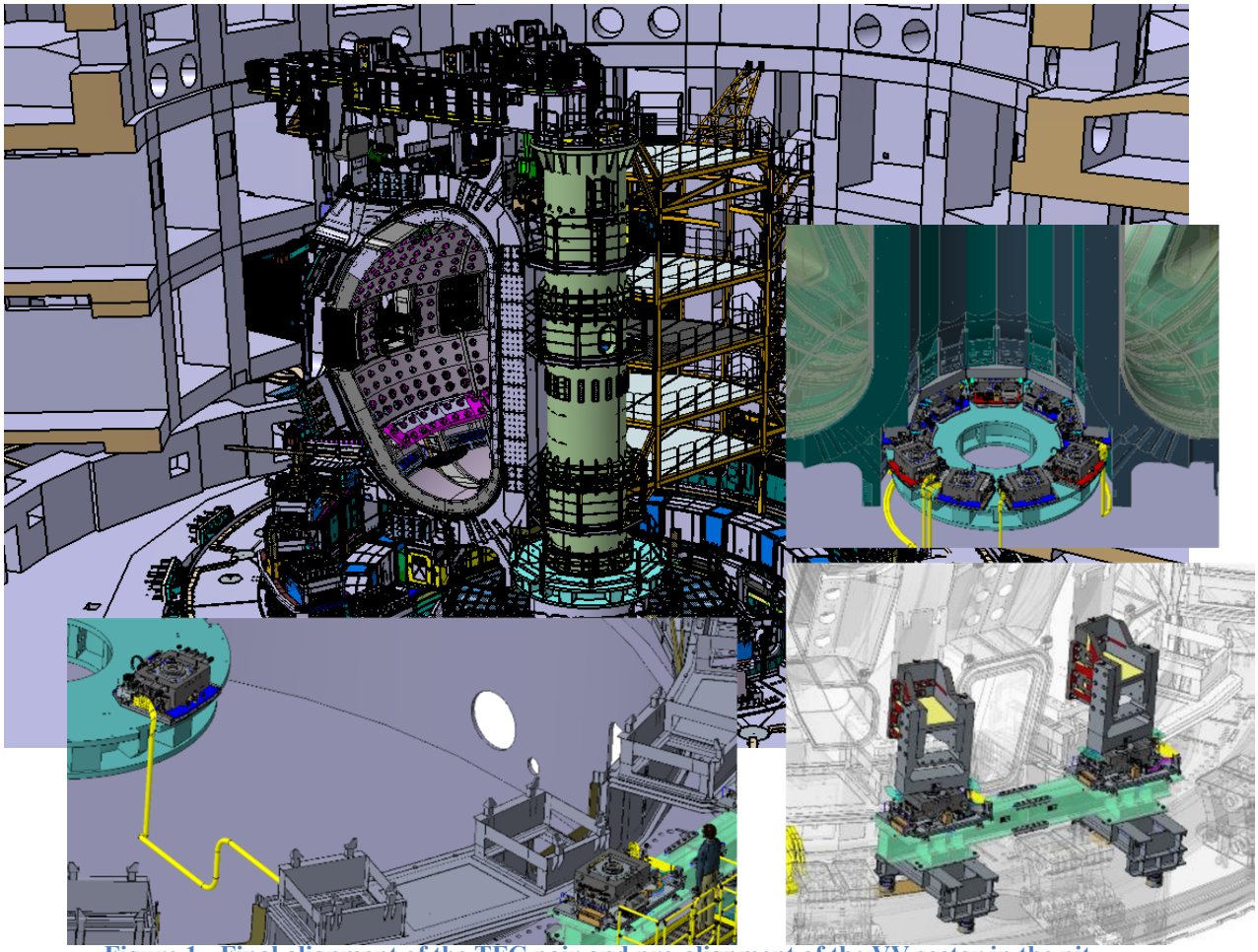

Figure 1 - Final alignment of the TFC pair and pre-alignment of the VV sector in the pit

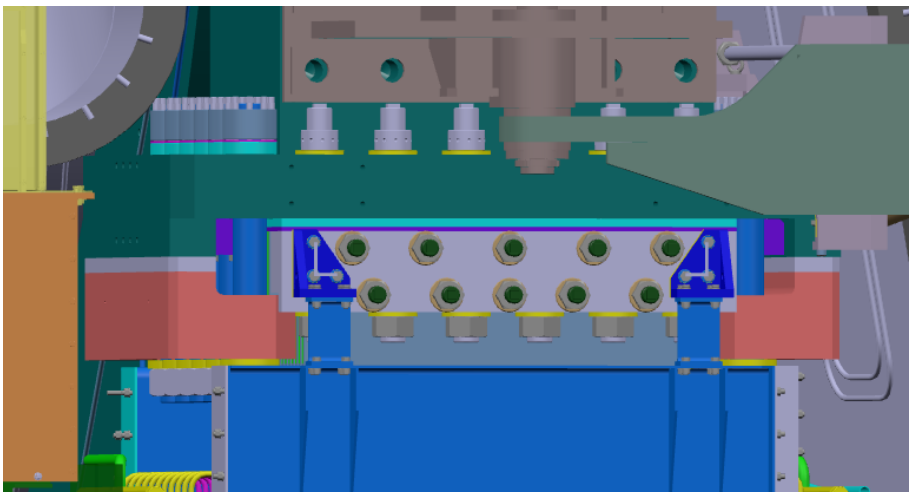

Figure 2 – Landing of TFC pair on TFGS. Customization and installation of shims and bolting between TFC and TFGS

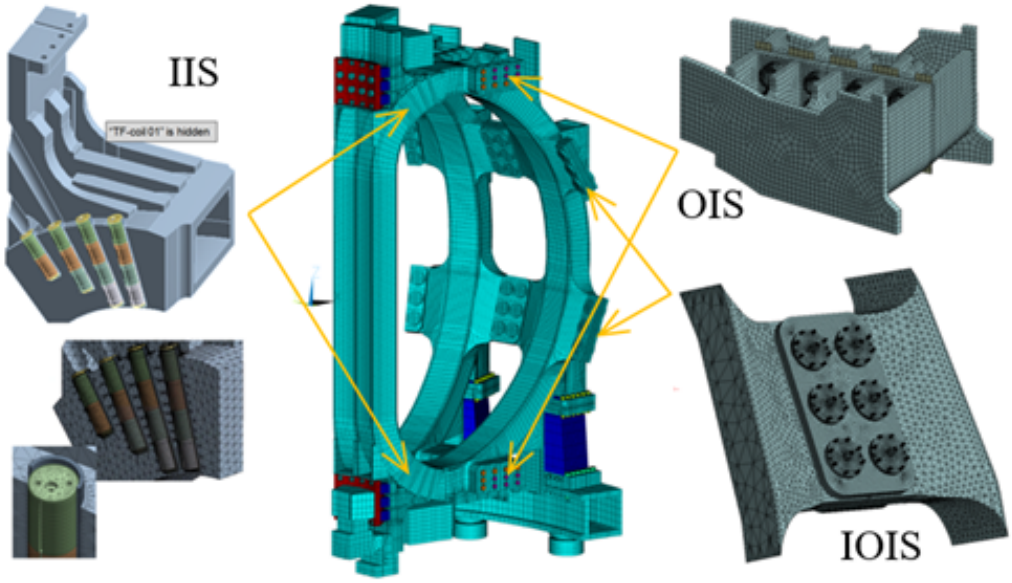

Figure 3 - Assembly and connections of the in pit inter-coil structures

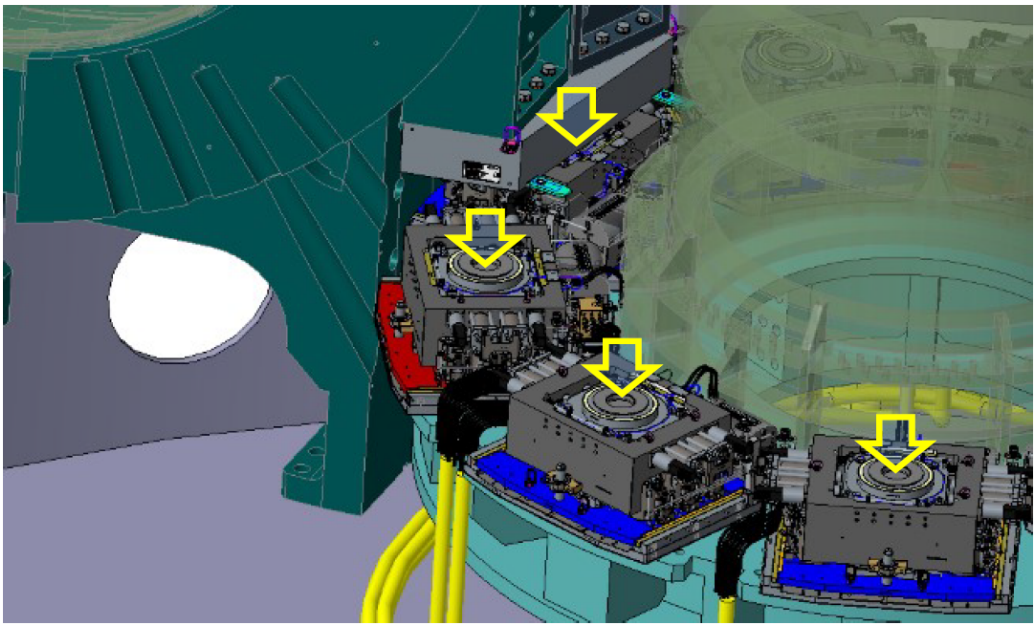

Figure 4 - Load transfer and final landing of the TFCs onto the TFGS

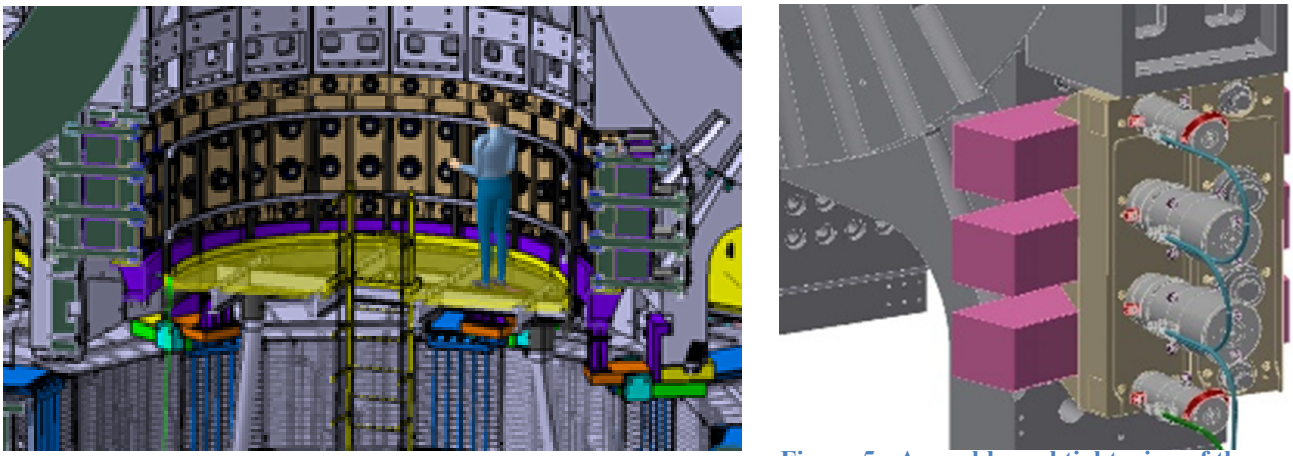

Figure 5 - Assembly and tightening of the pre-compression rings

There are 9 Sector Modules to be aligned and connected together with all the TFC Intercoil Structures so called Outer Intercoil Structures (OIS), Intermediate Outer Intercoil Structures (IOIS), Inner Intercoil Structures (IIS).

The scope of the work starts when the Sector Module 7 is already landed on the alignment tool in the pit "TIPI" (TFC In Pit Installation tool), ready to be aligned.

The contractor will have to be fully trained and qualified for the job. Some demonstration will be required as part of the procurement process.

Here below is a rough summary of the main steps required to fulfil the scope, the contractor shall:

- support the Sector Module Sub Assembly (SMSA) contract for the landing of the Sector Modules in the pit when operating the alignment tool (TIPI),
- proceed with the Sector Modules final alignment to its final target (required accuracy is within +/- 1mm) and its final landing on the Gravity Support,
- perform the required metrology, local reverse engineering and shims customization,
- perform shims insertion and final landing and the bolting of the TFCs onto the TFGS,
- operate the tools designed and provided by the IO for the execution of the Works.

Once the final position is reached and validated by IO reverse engineering, the contractor shall:

- perform the local metrology and associated reverse engineering to determine the required customization for the sleeves and the shims,
- proceed in dedicated workshop under the contractor responsibility with the sleeves and shims' customization (sleeves are stainless steel sleeves with alumina coating to ensure insulation between TFCs),
- Install sleeves, shims and bolts according to qualified procedures and requirement drawings to connect and tighten them to the required preload.
- where required, the Correction Coil (CC) cross beam will be customized and installed between Sector Modules,

Once all Intercoil Structures are assembled and once all radial beams are removed, the contractor will proceed with the A4 scope and shall:

- transfer the TFC torus load on the TFGS (release and removal of the inner beam interfacing with the TIPI) according to the sequence predetermined by IO,
- remove the central column and the corresponding inner TIPI interfaces,
- complete the remaining IIS Intercoil Structure assembly,
- install and assemble the lower Pre-compression ring in its final position,
- install and assemble the upper Pre-compression ring in its final position,
- support the bolting company to proceed with the tightening of the bolts,
- move the spare rings to their final position,

Once completed, the full TFCs torus is assembled and all coils are pre-tightened together. The magnetic center is determined and it is handed over to IO to proceed with the next phase.

5 Preliminary tendering timeline

The preliminary and tentative timeline for this Tender Procedure is presented in Table 6:

Market Survey	March 2024
Invitation To Tenderers – Pre-Qualification (PQ) package	April 2024
Prequalification submission (incl. physical demonstration)	May 2024
Invitation To Tenderers – Tender package	June 2024
Tender submission	July 2024
Award / Signature	Q3 2024

Table 6. Preliminary tendering timeline

6 Expected contract and main activities durations

The design, manufacturing, delivery, installation, on-site acceptance testing and commissioning of the system in the scope of this Technical Summary (as per description of the section 4) shall be completed no later than 4 years from the date of contract award and according to the following preliminary durations of the main activities in Table 7:

Activity	Repetition	Estimated duration
Final alignment and landing of 1 Sector Module	9	2 months
Assembly and connections of the in pit inter-coil structures of 1 Sector Module	9	2,5 months
Final load transfer and landing of the TFCs	1	1 month
Removal of the Central Column and inner beams	1	1 month
Assembly and tightening of the pre-compression rings	1	1,5 months

Table 7. Main activities durations

7 Experience

The Candidates will need to demonstrate, during the procurement pre-qualification (PQ) phase, that they have the capabilities to successfully perform the entire scope of work mentioned above. The Candidates shall have proven experience in contracts for similar assembly works to that described in this document.

During the PQ phase, the Candidates shall demonstrate through physical sampling that they are capable of carrying out some works to the requirements specified by the IO.

8 Candidature

Participation is open to any legal entity either an individual or a group (consortium) which is established in an ITER Member State.

A legal entity cannot participate individually or as a consortium partner in more than one application or tender.

A consortium may be 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 IO.

The consortium groupings shall be presented during the pre-qualification phase.

Legal entities belonging to the same legal grouping are allowed to participate separately if they are able to demonstrate independent technical and financial capacities.

The Candidates (individual or consortium) must comply with the selection criteria.

The IO reserves the right to disregard duplicated reference projects and may exclude such legal entities from the pre-qualification procedure.

The IO may also require the Candidates to use a nominated and already qualified subcontractor to perform the pre-compression rings tightening.