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**Technical Specifications (In-Cash Procurement)**

# Technical Description of TBM-Frame and Dummy-TBM for Call for Nomination

The purpose of this document is to provide the technical summary for the Mock-up and Final Product Manufacture of the TBM-Frame and Dummy-TBM in support of the Call for Nomination.

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# 1 Purpose

The purpose of this document is to provide the technical summary for the Mock-up and Final Product Manufacture of the TBM-Frame and Dummy-TBM in support of the Call for Nomination.

# 2 Supply Description

## 2.1 General description

The objective of ITER project is the demonstration of the scientific and technological feasibility of fusion energy. ITER is specified as a Nuclear Facility INB-174. The tritium fuel is required for the fusion reaction in DEMOnstration reactors and future commercial reactors but it is not available in nature because of its instability (half time: 12.32 years). The tritium breeding self-sufficiency is a key R&D item to be investigated in ITER tokamak. To investigate these R&Ds including the tritium breeding ratio, two equatorial ports in ITER are dedicated to operating test blanket modules (TBMs) using the port plugs.

Each TBM port plug (TBM-PP) consists of a TBM-Frame and two TBM-Sets. The typical system functions of TBM port plugs are to remove the surface heat flux and the nuclear heating within the allowable temperature, stress, and deformation limits, to reduce the nuclear responses in the Vacuum Vessel structural material.

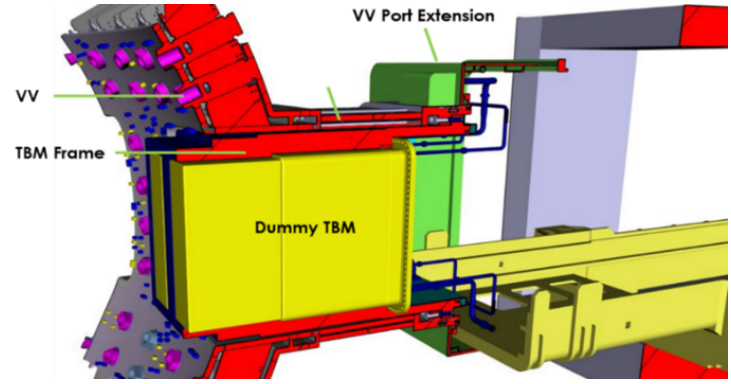


**Figure 1 TBM-Frame and Dummy-TBM in Vacuum Vessel Port Extension.**

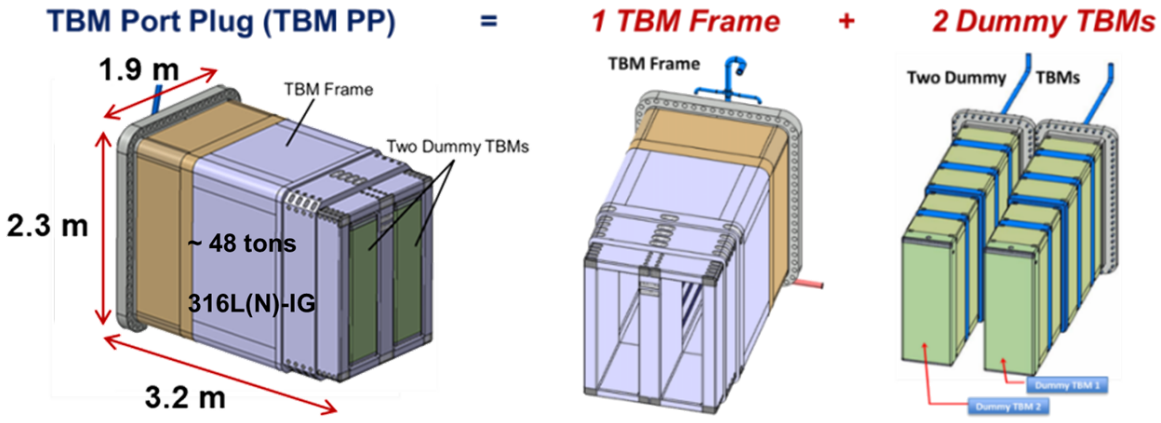


**Figure 2 TBM Port Plug with Dummy-TBM configuration.**

## 2.2 TBM-Frame

Each TBM-Frame has to accommodate two TBM-Sets (or one TBM-Set and one Dummy-TBM or two Dummy-TBMs) and provide a vertically oriented separation wall between them.

The main function of the TBM-Frame is to remove the surface heat flux and nuclear heating and to accommodate two Dummy-TBMs or two TBM-Sets. The main material is 316-L(N)-IG. Working conditions inside the Vacuum Vessel of ITER combine ultra-high vacuum, high temperatures and demanding electromagnetic conditions.

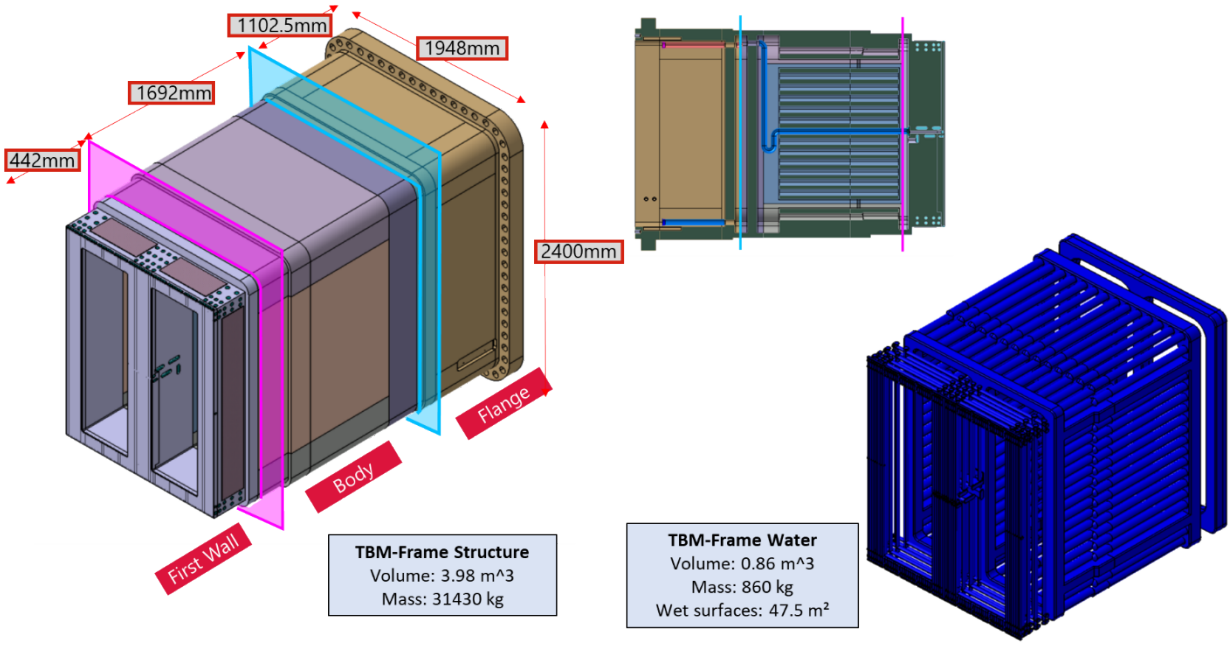


**Figure 3 TBM-Frame structure and cooling layout.**

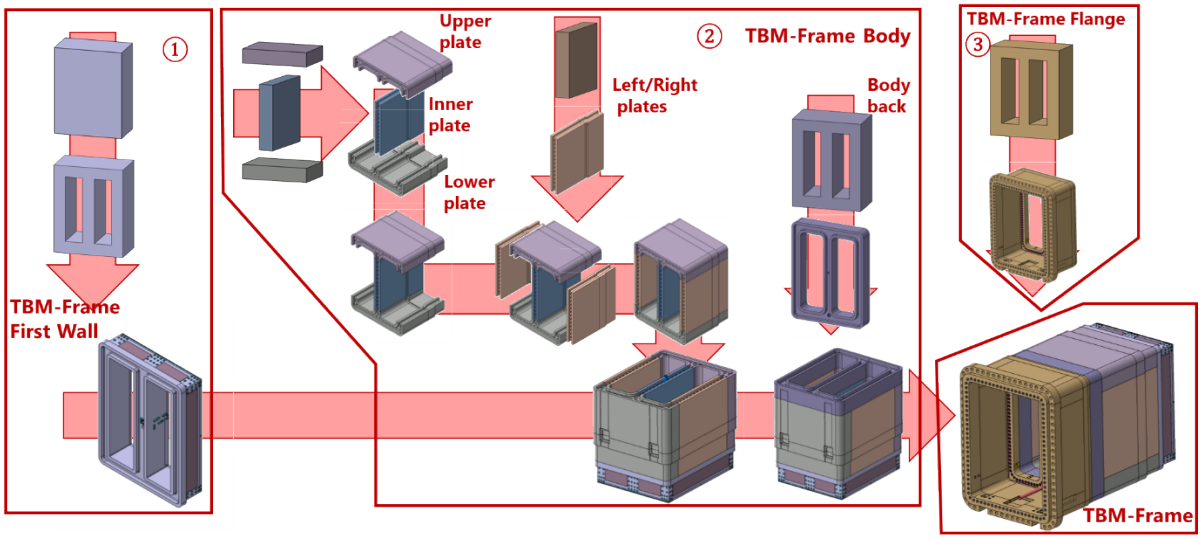


**Figure 5 A typical manufacture route of TBM-Frame.**

## 2.3 Dummy-TBM

Each Dummy-TBM has to be ready in order to replace TBM-Sets in case they are not available or failed during ITER operation

The main function of the Dummy-TBM is to remove the surface heat flux and nuclear heating. The main material is 316-L(N)-IG. Working conditions inside the Vacuum Vessel of ITER combine ultra-high vacuum, high temperatures and demanding electromagnetic conditions.

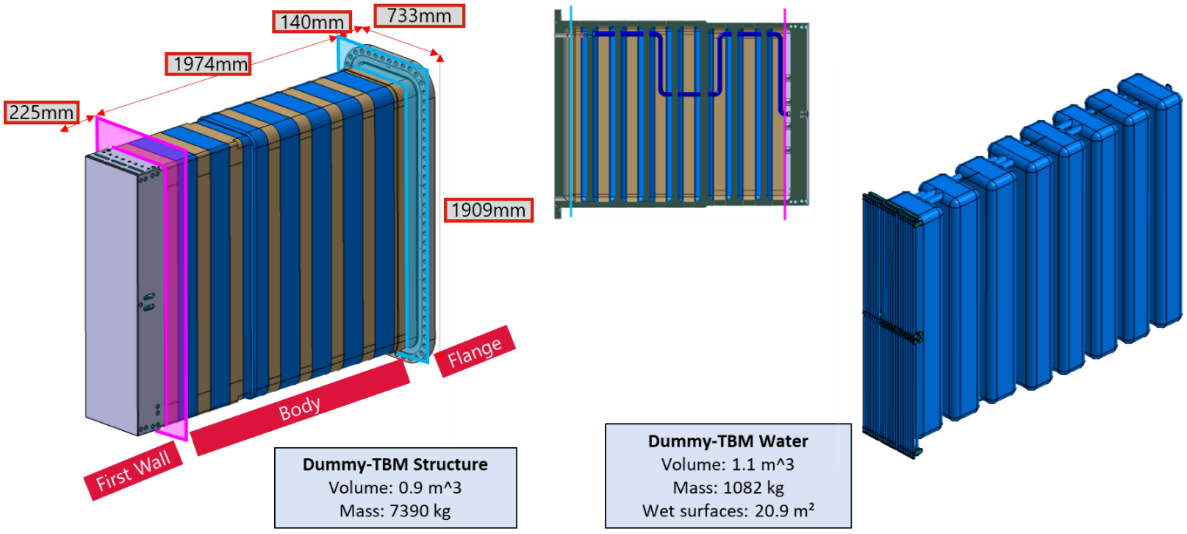


**Figure 4 Dummy-TBM structure and cooling layout.**

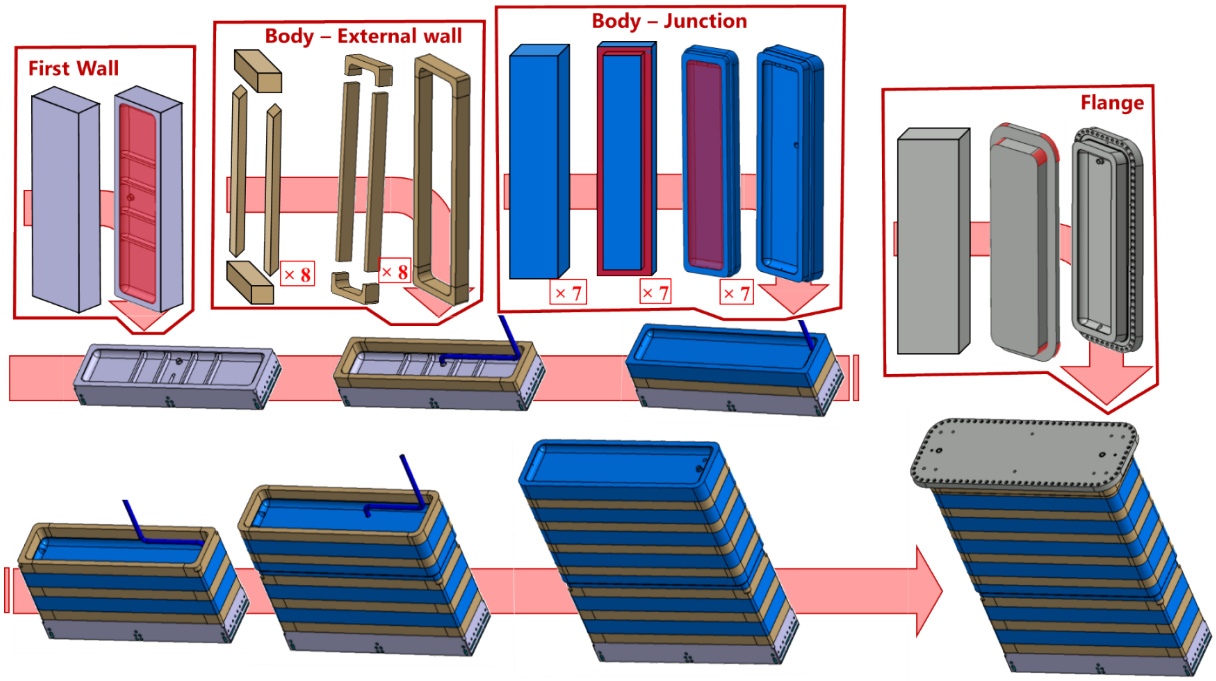


**Figure 5 A typical manufacture route of Dummy-TBM.**

# 3 Scope of Work

## 3.1 Mock-up Manufacture, Test, Qualification

The IO is responsible for carrying out the Final Design and providing the related 3D models, 2D drawings, and baseline documents. Thereafter the Contractor takes over responsibility for the Manufacturing Design and provides components that fulfils the specified requirements.

- Mock-up Design and Manufacture
  - TBM-Frame Mock-up: Production of a representative mock-up of the TBM-Frame, which will serve as a tool for evaluating the feasibility of the design, as well as its manufacturability and its integration with the TBM-set and the VV.
  - Dummy-TBM Mock-up: Fabrication of a representative mock-up of the Dummy-TBM, allowing for the simulation of operational conditions and testing of design assumptions.

- Mock-up Testing for qualification
  - Hydraulic Test (Flow Balance): Execution of hydraulic tests to ensure that the flow balance within the TBM-Frame and Dummy-TBM meets the required performance specifications.
  - Non-Destructive Testing (NDT) and Leak Testing: Implementation of NDT and leak tests to verify the structural integrity and sealing capabilities of the mock-ups, identifying any potential material or fabrication defects.
  - PP Assembly
    - Metallic Seal Compression Tests: Conduct compression tests on metallic seals to ensure their effectiveness in maintaining a leak-proof environment under operational pressures.
    - Vertical and Horizontal Loading and Bolting: Demonstration of the mock-ups' ability to withstand and be securely bolted under both vertical and horizontal loading conditions.
    - Horizontal Unloading and Unbolting: Verification of the procedures for safely unloading and unbolting the mock-ups from a horizontal position, ensuring that disassembly can be performed efficiently and safely.

## 3.2 Manufacture of Final Product and Delivery

The IO is responsible for carrying out the Final Design and providing the related 3D models, 2D drawings, and baseline documents. Thereafter the Contractor takes over responsibility for the Manufacturing Design and provides components that fulfils the specified requirements. The scope consists in the material procurement (unless delivered by the IO as free issued item) and manufacture design, in the preparation of the Manufacture Readiness Review (MRR), then manufacture and test of the TBM-Frame and Dummy-TBM and associated sub-components. It includes the Factory Acceptance Test (FAT), the delivery to IO and the related Site Acceptance Test (SAT), and PP assembly.

- 4 sets of TBM-Frame
- 5 sets of Dummy-TBM
- 2 sets of SVS pipes and IBED connection pipes, *to be detailed in the tender process*
- 2 sets of Dummy-Bioshield (56.PP.BS), *to be detailed in the tender process*

# 4 Experience Requirements

The ITER Organization is looking for Contractor with demonstrated experience delivering components for ultra-high vacuum applications, with manufacturing processes including machining, deep drilling, welding, NDT, etc.

The Contractor must prove its ability to provide in an organised way the competences specified in the Scope of Work above.

The Contractor should also have available a dedicated clean area, which shall only be operated by trained personnel to approved procedures.

The Tenderer shall have and maintain a valid ISO 9000 certification and shall have the duty to verify and document the equivalent quality level of all its subcontractors and consultants.

The following should be demonstrated in its proposal:

- Full knowledge of the codes, standard and nuclear regulation applied as below.
    - In general sense manufacturing methods and procedures shall follow the reference code RCC-MR 2007 for class 2 box structures in consistency with the document "Codes and Standards for ITER Mechanical Components".
    - It should be noted that there are no European or International Standards with respect to proper fabrication of ultra-high vacuum (UHV) components and so in lieu of an industrial Standard all component's fabrication shall simultaneously comply with the "ITER Vacuum Handbook".
    - For all dimensional characterization activities, the "ITER Dimensional Metrology Handbook" shall be applied as well.
    - EN, ISO and ASTM Standards referenced in any of above mentioned Codes and Standards shall also be considered as complementary applicable documents with regards to manufacturing requirements.
- Previous experience in application of the codes, standard and nuclear regulation applied in similar stainless steel Iter grade structures PIC components.
- To prove that have all the necessary machines and facilities for machining operation, welding (including EB welding), measurements, tests, preservation of cleanliness according to ITER vacuum handbook, manufacturing, assembly and storage areas level II according to RCC-MR Code, gun drilling in similar diameters, lengths, material, thickness and requirements.
- To prove that have all the necessary machines and facilities for leak testing (hot and cold), Flow test, Drain and Drying test, baking test and outgassing test.
- To prove that have certified and well-trained staff: design and analysis, NDT, leak test, machining including gun drilling for around 1 m in stainless steel.
- To prove that have certified and well trained staff in welding on staff: welders, welding coordinators and welding Engineers (ISO 14731, EN ISO 3834).
- To prove the subcontractor can produce design, manufacturing, testing, storing, handling and suppl.

# 5 Award of the Contract

The ITER Organization reserves the right to award one Contract for the whole scope of work or to split the procurement of the different systems in separate Contracts. Further details will be provided at the Call for Tender stage.

Suitable teaming arrangements for multiple companies are possible, where appropriate, to enhance the offering of the tenderer.

The language used at ITER is English. A fluent professional level is required (spoken and written English) with the Contractor liaising with ITER.

# 6 Candidature – Expression of Interest

Candidature is open to all companies participating either individually or in a grouping (consortium) which is established in an ITER Member State. A consortium may be a permanent, legally-established grouping or a grouping, which has been constituted informally – but formalized with engagement letters -- 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 consortia will be assessed as a whole. Consortia cannot be modified later without the prior approval of the ITER Organization.

# 7 Timetable for the Tender Process

The tentative schedule for this tender process is as follows:

| Process | Schedule |
|---|---|
| Call for Nomination (CfN) | *March 2025* |
| Pre-qualification | *May 2025* |
| Invitation for Call for Tender | *August 2025* |
| Tender Submission | *October 2025* |
| Contract signature | *June 2026* |