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Technical Summary

Engineering for Design Development of the first confinement components of ITER Diagnostics

Ref: IO/20/CFT/70000639/LLU

1. Purpose

The purpose of this Framework Contract is to provide specialized engineering and services for design development and manufacturing follow-up of the diagnostic components which forms the first and secondary confinement boundary of the ITER tokamak machine. It also includes some prototyping and testing required for design verification and qualification.

2. Background

Diagnostics are a critical part of the operation of ITER. They provide the means to observe, control and sustain the plasma performance over long timescales. ITER will operate with plasma current in the region of 15 MA and toroidal fields of 5 T. The pulse lengths will be in the region of 500 s typically and will extend up to a few thousand seconds during more advanced operation. A key objective of this device is Q=10 operation. This means that a typical fusion power of 500 MW will be provided for 50 MW input. While this is exactly what the ITER device is designed to do, it is nevertheless a challenging design objective in terms of diagnostics. This power will need to be managed and the generated neutrons will need to be confined. The device will be the first magnetic fusion device to be licensed as a nuclear facility. The combination of the above puts the ITER device in a new category of fusion machines.

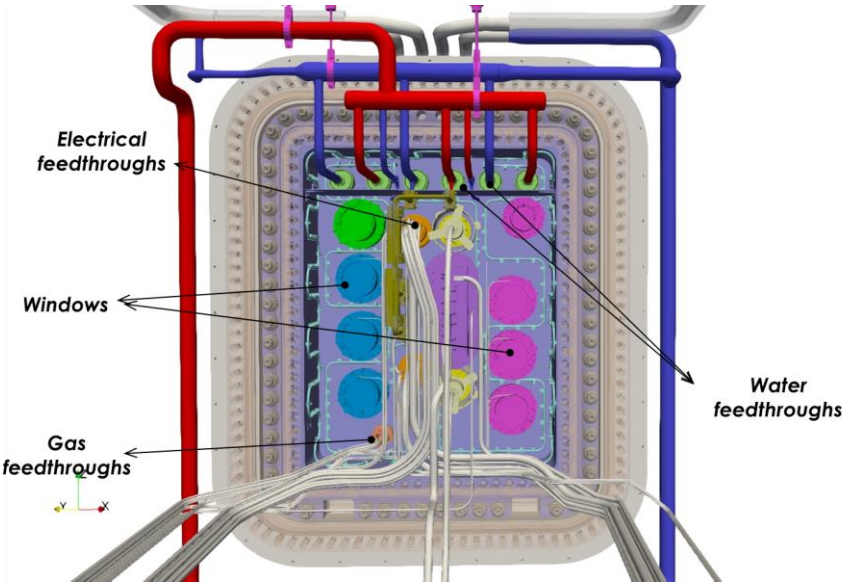

Figure 1 Example of the first confinement components integrated in the equatorial port plug #12

The ITER tokamak machine provides many openings, so called ports, in the vacuum vessel so that diagnostics can view and measure a plasma. In order to transfer the signals and the service lines (gas, water, electricity, etc), there are various feedthroughs and windows on the port closure plate which form the safety barrier together with the vacuum vessel port to confine toxic products (T, Be and activated products) as well as the primary ultra-high vacuum boundary. These SIC (safety importanct Components) components are critical in ITER operation to ensure the nuclear safety requirements.

3. Scope of work

The scope of the work covered in this specification is (1) to provide specialized expertise to contribute to, establish and reinforce the ITER Diagnostic Engineering Section for the development of the diagnostic SIC first confinement components and (2) to do some prototyping and testing required for the design verification and qualificaiton.

As a general statement, the details of the task to be provided by the Contractor will be defined in the Task Order Technical Specification.

These Technical Specifications will be defined specifically for each Task Order depending on the actual requirement and will include a technical scope, the organization of the Task Order within IO and a description of the deliverables.

The volume of the work to be carried out under this Framework Contract corresponds on average to 10 FTE (Full Time Equivalent) of trained engineers (mechanical engineer, electrical engineer, nuclear engineer and diagnostist) and technicians on yearly basis for the full Contract duration. As a variety of activities are required, the workload for the activities to be performed will not match exactly the number of individual resources. The number could vary from zero to 20 resources.

4. Work description

This framework contract covers the engineering support for the design development of the diagnostic first confinement components and the preparation work for their manufacturing.

Depending on the work activities, the provision of on-site diagnostics engineering expertise can be required to improve the work efficiency.

The following activities are foreseen:

- Development of final design of the first confinement components satisfying the ITER requirements of vacuum, nuclear safety, material, neutron/gamma irradiation environment, magnetic field, thermal environment, incidents and accidents (seismic, water accident, fire, etc).
  - Primary and secondary windows
  - Electrical feedthroughs including the in-vessel electrical compoennts (cables, connectors, etc)
  - Other SIC compoents such as isolation valves
- Finalization of Interface Sheets (IS) with the diagnostic systems and the port integrations
- Preparation of the component technical specification
- Finalization of detailed maintenance plan and maintenance tool design
- Finalization of qualification program to demonstrate the safety and the function performance
- Development for Remote Handling comptable design
- Integration design of the components in the port environment
- Thermal-mechanical analysis for design justification
- Preparation of Hand Over Package (HOP) documentation for design reviews

- Preparation of documentation for assembly, installation and commissioning
- Preparation of 3D CAD models and 2D drawings
- Preparation of Technical and Management specifications for manufacturing with industry
- Manufacturing of prototypes
- Testing for safety and performance qualification

5. Experience

The Contractor must have adequate experience and expertise for the work and activities as detailed below.

- Design development of mechanical-Electrical-Vacuum systems including Diagnostic Project Engineering
- Design development of optical component such as windows
- CATIA capability and skill for 3D CAD modeling and 2D drawings
- Thermal-mechanal analysis for design justification
- Design and manufacturing according to codes and standards (RCC-MR, ASME, EN, etc)
- Manufacturing capability relevant to windows, electrical feedthroughs and isolation valves.
- Testing capability relevant to windows, electrical feedthroughs and isolation valves

In addtion, it will be preferable to have the following knowledges and experiences.

- Nuclear Engineering related to the irradiation effect of materials
- Bonding technology between non-metallic material and the metalic structure (diffusion bonding, brazing, glass-to-metal sealing, etc)
- Anti-reflection coating
- EM absorbing coating
- Remote Handling (RH) compatable design and RH tool design
- Maintenance assessment considering human organization factor and occupational safety
- Qualification of Nuclear safety components
- Nuclear Safety Important requirements development including implementation
- General Project Engineering.

6. Duration of services

The Contract will be carried out over an initial firm period of four (4) years and an optional period of two (2) years. The Contract is scheduled to come into force in August 2021.

7. Candidature

Participation is open to all legal persons participating either individually or in a grouping (consortium) which is established in an ITER Member State. A legal person 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 ITER Organization. The consortium cannot be modified later without the approval of the ITER Organization.

Legal entities belonging to the same legal grouping are allowed to participate separately if they are able to demonstrate independent technical and financial capacities. Bidders' (individual or consortium) must comply with the selection criteria. IO reserves the right to disregard duplicated references and may exclude such legal entities form the tender procedure.

On 31 January 2020, the UK left the EU and Euratom with a transition period from 1st February to 31 December 2020 to be used to determine the conditions of their future relationship. Euratom is the ITER Member and the withdrawal of the UK from Euratom leads to the fact that UK is not anymore party to the ITER project.

Until the 31 December 2020, current end date of the transition period, UK entities retain the right to participate in IO procurement procedures.

8. Tentative Schedule of this Call for Tender

The indicative Call for Tender milestones are:

Call for Nomination	End of November, 2020
Issuing of Prequalification Invitations	Mid of January, 2021
Issuing of Call for Tender	End of March, 2021
Submission of Tenders	End of April, 2021
Award of Contract	Beginning of August, 2021

9. Reference

Further information on the ITER Organization procurement can be found at:
http://www.iter.org/org/team/adm/proc