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Technical Specifications (In-Cash Procurement)

Technical summary "Mirror Cleaning and Shutters Engineering"

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china eu india japan korea russia usa

Technical summary

Mirror Cleaning and Shutters Engineering

Purpose

The purpose of this Contract is to provide engineering and design development of First Mirror cleaning and Shutters systems for ITER Port Plugs and Diagnostics Division.

The ITER Organization (IO) reserves the right to award up to a maximum of two (2) framework Contracts.

Background

A key objective of ITER is to demonstrate a power multiplication of Q=10 i.e. to generate 10 times more power from fusion reactions than required to heat the plasma, for extended periods of time ~ 400 s. ITER will be the first magnetic fusion device to be licensed as a nuclear facility (INB 174). Diagnostic systems are critical for the successful operation of ITER. They provide the means to observe, control, and sustain the plasma performance over long timescales.

Access to diagnostic systems in the tokamak area is generally challenging after initial assembly. This is a key driver in the design of systems and gives rise to a requirement for redundancy and/or high reliability. Typically, to prevent neutron leakage from the vacuum vessel, light from the plasma has to be collected using a set of mirrors inside a labyrinth structure. Plasma facing mirrors (first mirror) are located behind opening inside the diagnostic first wall. A number of plasma wall interaction phenomena will lead to degradation of the reflectivity of the mirror surface thus decreasing the performance of whole diagnostic system. In particular, metallic impurities escaping from the plasma can form layers of material on the mirror surface. Also, energetic charge exchange particles from the plasma sputter walls of the mirror duct resulting in possible redeposition of some diagnostic first wall materials on the mirror surface. Loss-of-Cooling-Accident might lead to heavy oxidation of the mirror surface. In addition, nitrogen is considered to be used for radiative divertor cooling, to decrease the heat fluxes to the divertor. The former implies that beryllium nitride might appear on the mirror surface. Pollution of the first mirror surface can therefore have different origins. Taking into account the very limited access to the port plugs, first mirrors should be equipped with in-situ cleaning systems (see for example [1], [2]) to periodically recover mirror reflectivity independently on the type of deposits.

The second option is to prevent as much of the surface modification as possible using a shutter system. In most cases the shutters should be closed when the diagnostic systems is not

operating and should be open during the measurements. Both systems, mirror cleaning and shutters should operate in the ITER harsh environment with high reliability.

References

[1] Cleaning of first mirrors in ITER by means of radio frequency discharges. F.Leipold et al., RSI 87 (2016) 11D439;
[2] Towards plasma cleaning of ITER first mirrors. L.Moser et al., Nucl. Fusion 55 (2015) 063020.

Scope of work

The scope of the development services requires that the Contractor(s) companies provide specialized engineering design capabilities such as mechanical engineering, vacuum equipment engineering, electrical engineering, radio frequency and glow discharge equipment engineering, optical engineering.
The required details of the work, the organization of the Task Order and a description of the deliverables will be provided by the IO-CT in the Task Order Technical Specifications to the Contractor(s) depending on the actual requirements.

The scope of work covers predominantly the provision of off-site engineering expertise supported by on-site engineering if necessary. Successful implementation of mirror cleaning and shutter systems may require general engineering tasks connected with design of port plug infrastructure, power feeding, gas supplying, etc. The following activities are foreseen:

- Design and development of mirror cleaning system:
  - Engineering development of the mirror cleaning system;
  - Development of mechanical solutions and radio-frequency power feeding solutions for integration of the mirror cleaning system;
  - Development of interfaces for mirror cleaning system;
  - Evaluation and development of reports for mirror cleaning system;
  - Manufacturing of the mirror cleaning system mock ups;
  - Experimental validation of the mirror cleaning system design;
  - Iterative design improvement of the mirror cleaning system including re-manufacturing;
  - Analysis of the results as required.

- Design and development of shutter system:
  - Engineering development of the shutter system;
  - Development of interfaces for the shutter system;
  - Evaluation and development of reports for the shutter system;
  - Evaluation of the reliability and longevity of the shutters;
  - Manufacturing of the shutter system mock ups;
  - Experimental validation of the shutter operation and iterative design improvement including re-manufacturing;
  - Analysis of the results as required.

- General engineering and manufacturing:
  - Electrical engineering;
  - Optical engineering;
  - Optomechanical engineering;

- Radio Frequency engineering;
- electrical connector engineering;
- Mock up engineering and manufacturing;
- Gas supply engineering;
- Water supplying engineering;
- Mechanical engineering;
- Development of systems to support above tasks.

The ITER project Port Plugs and Diagnostic scope comprises more than hundred diagnostics projects including diagnostics, structural engineering, conventional and Nuclear Protection Important Components which require a variety of activities. Engineering activities can also depend on the results of R&Ds for Port Plug and Diagnostic. As a consequence the workload for the activities to be performed can vary in time.

Experience

The Candidates(s) shall typically have experience as detailed below:

- Mechanical, electrical, vacuum, optical systems;
- Basic knowledge of plasma surface interaction processes;
- Expertise in glow discharges including Radio-Frequency and Direct Current discharges.

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 2017.

Timetable

The tentative timetable is as follows:

Description	Date
Release of Pre-qualification, to be possibly combined with call for tender	May 2017
Tender submission date	July 2017
Indicative Award date	July 2017
Indicative Contract signature	August 2017
Indicative Contract start date	September 2017

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.

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