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VERSION CREATED ON / VERSION / STATUS
05 Nov 2015 / 1.4 / Approved

EXTERNAL REFERENCE / VERSION

Technical Specifications (In-Cash Procurement)

Engineering Design and Structural assessment of ITER Diagnostics Components

Analysis that supports the diagnostic design, with particular emphasis in the areas of diagnostic integration within ports cell area

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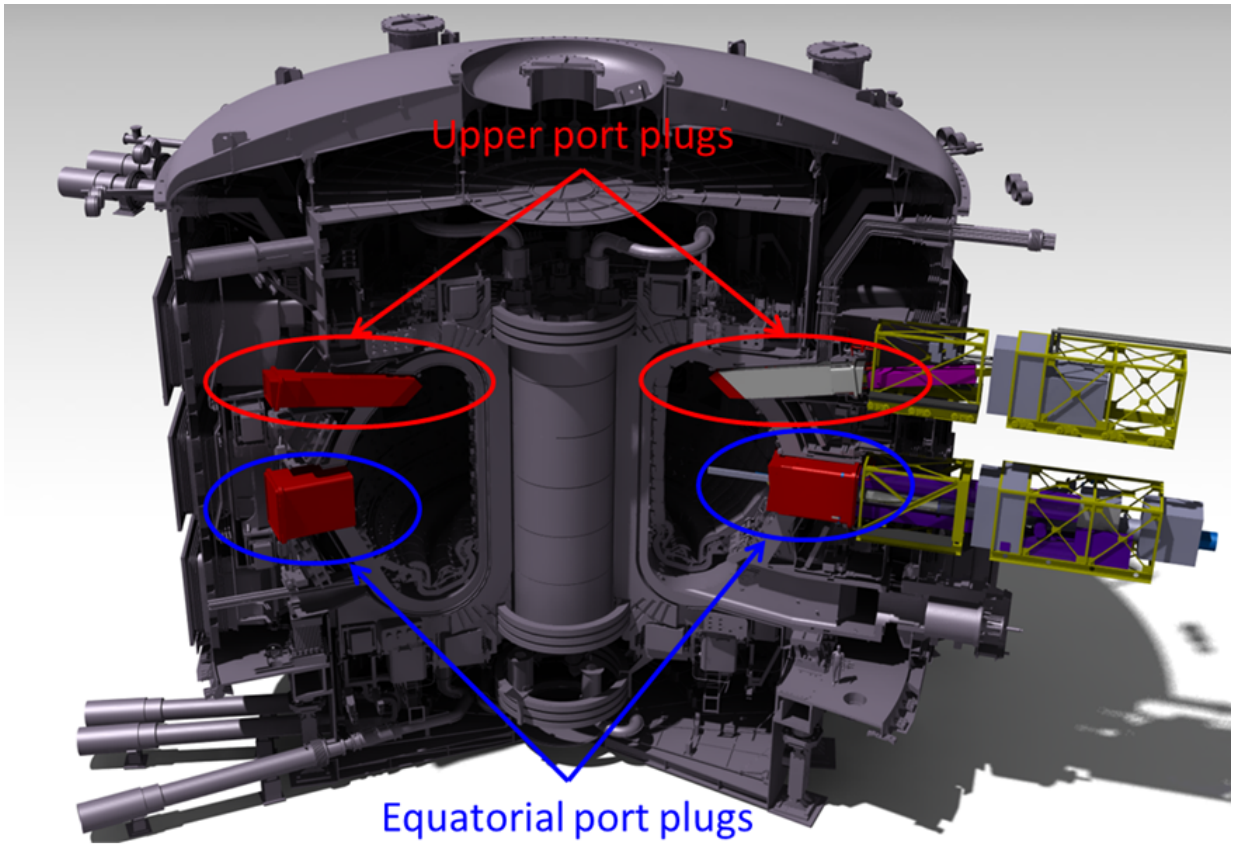
1 Purpose

The objective of this engineering contract is in the analysis that compliments the diagnostic design, with particular emphasis in the areas of diagnostic integration within ports cell area. The diagnostics have to be integrated within tokamak complex.

2 Scope

The scope of work will be the following Diagnostics development activities: **General Engineering work to advance diagnostic design and integration in the tokamak complex.**

The work described below is related to the design of the equipment required to physically compliment the diagnostics in ITER, e.g. port plugs and similar structures, and in some cases the diagnostics themselves.



3 Definitions

For a complete list of ITER abbreviations see: ITER Abbreviations (ITER_D_2MU6W5).

4 References

Acronyms:

- C-R: Contractor Responsible. See Contract specifications for definition of duty.

- C-TRO: Contractor Task Responsible Officer. See Contract specifications for definition of duty.
- IO-RO: ITER Organization Responsible Officer. See Contract specifications for definition of duty.
- IO-TRO: ITER Organization Task Responsible Officer. See Contract specifications for definition of duty

5 Estimated Duration

The contract duration shall be up to 2 years and shall commence after the official start date and upon the mutual agreement of both parties. It is envisaged that a significant part of the services shall be performed ON Site at IO, however, some work could be performed off site. Any such off site work shall be defined at a later stage.

6 Work Description

The objective of this engineering contract is in the analysis of the diagnostic design, with particular emphasis in the areas of mechanical, thermo-hydraulic and electromagnetic analysis.

- Suggesting Mechanical and Thermo-Hydraulic design of diagnostic components, especially optical systems.
- Mechanical (static/dynamic/linear/non-linear), Thermo- Hydraulic and Electromagnetic analysis of General diagnostics, diagnostics port plugs, diagnostics port plug structures and diagnostics windows assemblies.
- Analysis referring to the definition of loads (Mechanical, Thermo- Hydraulic and Electromagnetic analysis) to be included in Load Specifications of diagnostic components.
- Perform, collate and check the analytical and numerical calculations supporting diagnostic design in the area of Mechanical, Thermo-Hydraulics and Electromagnetics.
- Code assessment and structural integrity evaluation following appropriate Codes and Standards (nuclear/non-nuclear) against diagnostic designs, examples of such codes would be such like RCC-MR and ASME codes.
- Perform independent verifications of structural integrity reports of nuclear equipment.
- Load specifications for diagnostic components production.
- Provide appropriate Structural Analysis, Technical Analysis and Structural Integrity Reports in a suitable format as per IO templates.
- Fulfil its mission in the design engineering and analysis area.

7 Responsibilities

7.1 Contractor’s Responsibilities

In order to successfully perform the tasks in these Technical Specifications, the Contractor shall:

• Strictly implement the IO procedures, instructions and use templates;

• Provide experienced and trained resources to perform the tasks;

• Contractor’s personnel shall possess the qualifications, professional competence and experience to carry out services in accordance with IO rules and procedures;

• Contractor's personnel shall be bound by the rules and regulations governing the IO ethics, safety and security IO rules.

7.2 IO's Responsibilities

The IO shall:
• Nominate the Responsible Officer to manage the Contract;
• Organise a monthly meeting(s) on work performed;
• Provide offices at IO premises.

8 List of deliverables and due dates

D #	Description*	Due Dates
D1	Document describing the preliminary assessment of opto-mechanical designs for diagnostic systems located inside equatorial port 17. Cross-check of the diagnostic performance versus typical loads on diagnostic components from external sources (EM loading, thermal, seismic); as well as from interfacing loads within the same port. Creation of hits classified by category.	T0 + 1 month
D2	The 55.GC Tritium Monitor Neutronic analysis is located in the Equatorial port number 17 in the Diagnostic Shield module number 2. We pass the CDR of this diagnostic and some chits request some additional calculation. In order to close this CDR we need to evaluate the temperature on the first mirror and on the shutter during operation. The structural integrity report has already been made on 55-GC tritium monitor [RW9PT5] with associated presentation [RZG8UF], but an update on this document need to be done in order to cover the comment that appear during the CDR. This report need to make a clear description of the model and the mesh use for these analyses. This report need to have a clear description of the boundary condition that apply to the model and the assumption done is in order to make the analysis	T0 + 2 months

D3	The 55.EE Hard X-Ray monitor is in the Equatorial port 12 in the drawer 2. In order to validate the design of this diagnostic we need to have a report on the thermos-mechanical analysis. This deliverable will be only focus on the in port part. These analyses will be focus on the detector and the fibre optic located in the Diagnostic Shield Module (DSM). This report need to make a clear description of the model and the mesh use for these analyses. This report need to have a clear description of the boundary condition that apply to the model and the assumption done is in order to make the analysis	T0 + 3 months
D4	The 55.G9 Dust Monitor is located in the Vacuum Vessel at the lower port level. This diagnostic use the lower port in order to come into the Vacuum Vessel. After this diagnostic use these own pipe in order to go up to the Divertor Cassette. We need to assess the feasibility of this pipe due to the high level of radiation and magnetic flux. In order to do this we need to have a thermomechanical analysis of this diagnostic. This report need to make a clear description of the model and the mesh use for these analyses. This report need to have a clear description of the boundary condition that apply to the model and the assumption done is in order to make the analysis	T0 + 5 months
D5	In order to validate if the 55.EE Hard X-Ray could survive to ITER during the 20 year life time. We need to avec an evaluation of the load combination in accordance with the load specification done for this diagnostic. This report need to make a clear description of the model and the mesh use for these analyses. This report need to have a clear description of the boundary condition that apply to the model and the assumption done is in order to make the analysis And a table with all the load use and the stress included by each case need to be provide to IO for this diagnostic.	T0 + 7 months

D6	For the 55.G9 Dust Monitor we need to have a document that will summarise all the load (ex. Seismic, heating, electromagnetic etc) and more particularly the stress induce by all these load and load combination. This document will be the Structural Integrity report for this diagnostic. This report need to make a clear description of the model and the mesh use for these analyses. This report need to have a clear description of the boundary condition that apply to the model and the assumption done is in order to make the analysis And a table with all the load use and the stress included by each case need to be provide to IO for this diagnostic	T0 + 9 months
D7	The 55.FA Line Averaged Density Diagnostic is located in the Equatorial port number 08 in the Diagnostic Shield module number 1 and 2. We need to evaluate the stress induce during different case in accordance with the load specification of this diagnostic. This diagnostic is compose of different part the front part name antenna will be very close to the plasma and we need to evaluate the temperature and the stress induce during the operation. After we have some wave guide attach to the Diagnostic Shield Module and we need to evaluate the stress induce by the thermal expansion. The las part of the diagnostic in the port plug will be the windows at the closure flange and we need to know if this part will survive to different load case. This report need to make a clear description of the model and the mesh use for these analyses. This report need to have a clear description of the boundary condition that apply to the model and the assumption done is in order to make the analysis	T0 + 11 month

D8	The 55.FA Line Averaged Density Diagnostic is located in the Equatorial port number 08 this deliverable will be focus on the wave guide located in the Interspace Support Structure, in the Port Cell Support structure and in the port cell lintel. We need to evaluate the stress induce during different case in accordance with the load specification of this diagnostic. This diagnostic is compose of different part in the Interspace Support Structure we will have some waves guide that will be support ted by this structure we need to have a clear idea of the load apply to the support and on the structure. In the Bio-shield area a dog leg will be present and we need to evaluate the temperature on the mirror in order to evaluate if the mirror will need a dedicated cooling or not. In the port cell the attachment on the embedded plate will need a structure and we need to assess the load transmit to the building via these anchor point. This report need to make a clear description of the model and the mesh use for these analyses. This report need to have a clear description of the boundary condition that apply to the model and the assumption done is in order to make the analysis	T0 + 13 months
D9	The 55.B9: Lost Alpha Monitor is located in the Equatorial port number 08 in the Diagnostic Shield module number 2. We need to evaluate the stress induce during different case in accordance with the load specification of this diagnostic. This diagnostic is composing of different part the front part that is an arm that will move in order to modify the position of the detector. This will be very close to the plasma and we need to evaluate the temperature and the stresses induce during the operation. After we have some mirror attach to the Diagnostic Shield Module and we need to evaluate the stress induce by the thermal expansion. This report need to make a clear description of the model and the mesh use for these analyses. This report need to have a clear description of the boundary condition that apply to the model and the assumption done is in order to make the analysis	T0 + 14 months

D10	The 55.B9: Lost Alpha Monitor is located in the Equatorial port number 08 this deliverable will be focus on the equipment located in the Interspace Support Structure and in the Port Cell Support Structure. We need to evaluate the stress induce during different case in accordance with the load specification of this diagnostic. This diagnostic is composing of different part like fibre optic; mirror etc for these component we need o have an idea of the stress induce by the different loads. This report need to make a clear description of the model and the mesh use for these analyses. This report need to have a clear description of the boundary condition that apply to the model and the assumption done is in order to make the analysis	T0 + 15 months
D11	For the 55.FA Line Averaged Density Diagnostic we need to have a document that will summarise all the load (ex. Seismic, heating, electromagnetic etc) and more particularly the stress induce by all these load and load combination. This document will be the Structural Integrity report for this diagnostic. This report need to make a clear description of the model and the mesh use for these analyses. This report need to have a clear description of the boundary condition that apply to the model and the assumption done is in order to make the analysis And a table with all the load use and the stress included by each case need to be provide to IO for this diagnostic.	T0 + 17 months
D12	For the 55.B9: Lost Alpha Monitor that are located in the Equatorial port 08, we need to have a document that will summarise all the load apply to this diagnostic and more particularly the stress induce by all these load and load combination. This document will be the Structural Integrity report for this diagnostic. This report need to make a clear description of the model and the mesh use for these analyses. This report need to have a clear description of the boundary condition that apply to the model and the assumption done is in order to make the analysis And a table with all the load use and the stress included by each case need to be provide to IO for this diagnostic.	T0 + 19 months

D13	The 55.GB: Micro waves detector is located in the Equatorial port number 08 in the Diagnostic Shield module number 2 and 3. We need to evaluate the stress induce during different case in accordance with the load specification of this diagnostic. This diagnostic is composing of different part, close to the plasma we have a detector this detector will see the radiation that will come from the plasma. From the fact that this part is very close to the plasma, we need to evaluate the temperature and the stresses induce during the operation. After we have some cable routing attach to the Diagnostic Shield Module and we need to evaluate the stress induce by the thermal expansion. This report need to make a clear description of the model and the mesh use for these analyses. This report need to have a clear description of the boundary condition that apply to the model and the assumption done is in order to make the analysis	T0 + 21 months
D14	For the 55.GB: Micro waves detector that are located in the Equatorial port 08, we need to have a document that will summarise all the load apply to this diagnostic and more particularly the stress induce by all these load and load combination. This document will be the Structural Integrity report for this diagnostic. This report need to make a clear description of the model and the mesh use for these analyses. This report need to have a clear description of the boundary condition that apply to the model and the assumption done is in order to make the analysis And a table with all the load use and the stress included by each case need to be provide to IO for this diagnostic.	T0 + 24 months

9 Acceptance Criteria

These criteria shall be the basis of acceptance by IO following the successful completion of the services. These will be in the form of monthly progress reports as indicated in section 8, table of deliverables and further detailed below:

- Reports as deliverables shall be stored in the ITER Organization's document management system, IDM by the Contractor for acceptance. A named ITER Organization's Contract
- Technical Responsible Officer is the Approver of the delivered documents.
- The Approver can name one or more Reviewers(s) in the area of the report's expertise.
- The Reviewer(s) can ask modifications to the report in which case the Contractor must submit a new version.

- The acceptance of the document by the Approver is the acceptance criterion.

10 Specific requirements and conditions

- Experience in the design and analysis of tokamak systems
- Experience with structural, thermo-hydraulic and electromagnetic analysis (both analytic and computational) of mechanical systems
- Appropriate industrial codes (e.g. ASME VIII Div 2, ASME III, RCCMR)

11 Work Monitoring / Meeting Schedule

The work will be managed by means of Progress Meetings and/or formal exchange of documents transmitted by emails and JIRA task which provide detailed progress. Progress Meetings will be called by the ITER Organization, to review the progress of the work, the technical problems, the interfaces and the planning. It is expected that Progress Meeting will be held weekly or biweekly or as needed, via videoconference. Progress meetings will involve C-R, CTROs, IO-RO and IO-TROs.

The main purpose of the Progress Meetings is to allow the ITER Organization/Diagnostics Division and the Contractor Technical Responsible Officers to:

a) Allow early detection and correction of issues that may cause delays;
b) Review the completed and planned activities and assess the progress made;
c) Permit fast and consensual resolution of unexpected problems;
d) Clarify doubts and prevent misinterpretations of the specifications.

In addition to the Progress Meetings, if necessary, additional meetings to address specific issues to be resolved may be requested by the ITER Organization.

It is expected that on occasion a presentation to Topical Technical Meetings either by videoconference or in person may be required.

For all Progress Meetings, a document (the Progress Meeting Report) describing tasks done, results obtained, blocking points and action items must be written by the Contractor. Each report will be stored in the ITER IDM in order to ensure traceability of the work performed.

12 Delivery time breakdown

See Section 8 – Deliverables and Due Date

13 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 ITER Procurement Quality Requirements (ITER_D_22MFG4).

Prior to commencement of the task, a Quality Plan must be submitted for IO approval giving evidence of the above and describing the organisation for this task; the skill of workers involved in the study; any anticipated sub-contractors; and giving details of who will be the independent checker of the activities (see Procurement Requirements for Producing a Quality Plan (ITER_D_22MFMW)).

Documentation developed as the result of this task shall be retained by the performer of the task or the DA organization 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 task activity such as analysis and/or modelling, etc. shall be reviewed and approved by the IO prior to its use, in accordance with Quality Assurance for ITER Safety Codes (ITER_D_258LKL).

14 CAD Design Requirements (if applicable)

For the contracts where CAD design tasks are involved, the following shall apply:

The Supplier shall provide a Design Plan to be approved by the IO. Such plan shall identify all design activities and design deliverables to be provided by the Contractor as part of the contract.

The Supplier shall ensure that all designs, CAD data and drawings delivered to IO comply with the Procedure for the Usage of the ITER CAD Manual (2F6FTX), and with the Procedure for the Management of CAD Work & CAD Data (Models and Drawings 2DWU2M).

The reference scheme is for the Supplier to work in a fully synchronous manner on the ITER CAD platform (see detailed information about synchronous collaboration in the ITER GNJX6A - Specification for CAD data production in ITER Contracts.). This implies the usage of the CAD software versions as indicated in CAD Manual 07 - CAD Fact Sheet (249WUL) 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 Supplier.

15 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 Subcontractors 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).
- 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 Subcontractor following the requirements of the Order 7th February 2012 [20].