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Technical Specifications (In-Cash Procurement)

Technical Specification - Hot Cell Complex - Building Engineering

This document aims at specifying four types of transverse activities to be performed for the Hot Cell Complex design activities:
1 – Hot Cell configuration before the nuclear phase, potential delayed procurement and temporary means for the Beryllium phase,
2 – Technical recommendations on:
Civil Work structure, Stainless Steel liner, Heating, ventilation and air conditioning (HVAC), Liquid and Gas, Building interfaces between the building and the systems (standardization, harmonization, ...

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1 Purpose

This document aims at specifying four types of transverse activities to be performed for the Hot Cell Complex design activities:

1 – Hot Cell configuration before the nuclear phase, potential delayed procurement and temporary means for the Beryllium phase,

2 – Technical recommendations on:

- Civil Work structure,
- Stainless Steel liner,
- Heating, ventilation and air conditioning (HVAC),
- Liquid and Gas,
- Building interfaces between the building and the systems (standardization, harmonization, flexibility):
  - Permanent penetrations, refilling,
  - Temporary openings,
  - Anchorage of loads (in particular Embedment Plates),

3 – Specification of Civil Work engineering activities for preliminary and detailed design stages,

4 – Review of deliverables issues by a third party (consortium in charge of the Hot Cell Engineering contract for the conceptual design stage), proposing in parallel design improvements.

2 Scope

The scope includes the overall Hot Cell Complex, including the building and the processes, in particular the Hot Cell Complex building, the Radwaste process and the Hot Cell Remote Handling System.

The Hot Cell Facility is described in ITER_D_L9V43M - Functional description of the Hot Cell Building. The Radwaste facility is described in ITER_D_L5G67Y - HCC TF - Functional description of the Radwaste Building. The Personal Access Control Building is described in ITER_D_L5G8Z5 - HCC TF - Functional description of the Personnel Access Control Building.

To be noted that the Hot Cell layout has changed in 2016 (see figures below of 2 specific levels and ITER_D_TVL52W - 2016 HCC - General Arrangement - In work).

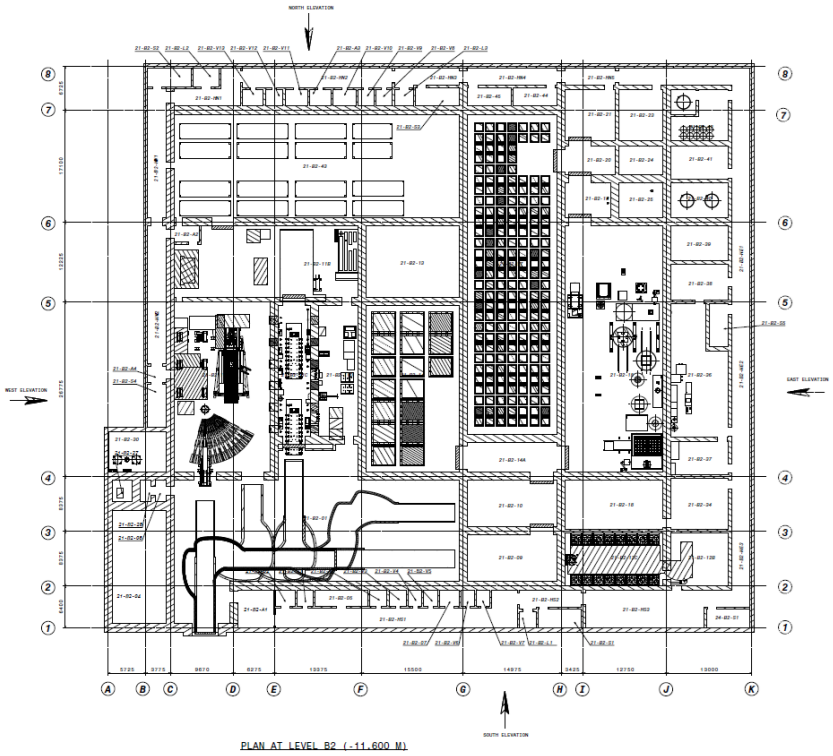

Figure 1 Level B2 of the 2016 Design of the Hot Cell Complex

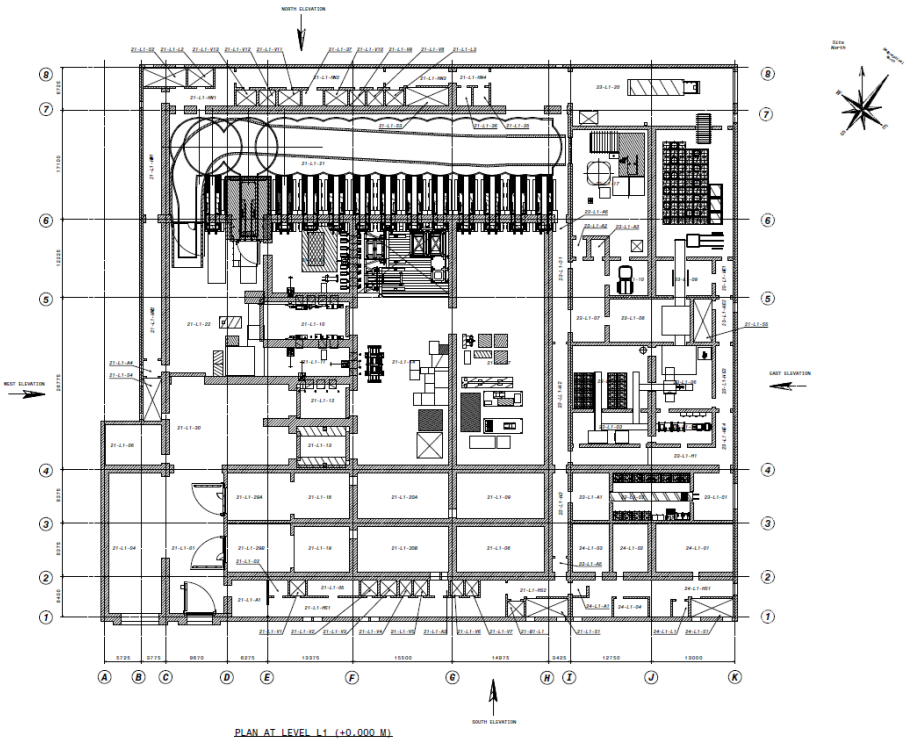

Figure 2 Level L1 of the 2016 Design of the Hot Cell Complex.

The table in appendix summarizes main features of the Hot Cell Complex, illustrating the level of complexity and the required skills for this contract.

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
- PBS: Project Breakdown Structure

5 Estimated Duration

The contract duration shall be one year and shall commence after the official start date and upon the mutual agreement of both parties. The services shall be performed on-site at IO.

6 Work Description

6.1 Context

Three types of activities are being performed in 2016 / 2017 aiming at designing the Hot Cell Complex (HCC) and answering to the French regulator:

- Design activities of the HCC buildings,
- Design activities of the Radwaste and Remote Handling System located within the HCC,
- Safety analysis based on the Hot Cell Complex design.

One major contract has been placed for the Hot Cell buildings engineering activities (technical specification at the link ITER_D_SW5UFF - Technical Specification Hot Cell Complex - Building Engineering Contract), while series of contracts have been launched in order to study the Radwaste and Remote Handling Systems located within the Hot Cell Complex. The requested work is focused on design activities, cost and safety optimization.

Goal is also to prepare documents for the tender phase for the Hot Cell Engineering contract (preliminary and final design stages).

6.2 Objective of the contract

The objective of the contract is broken down into 12 deliverables which correspond in fact to four types of activities as described below.

6.2.1 Hot Cell configuration for the Be phase

Goal of this activity is:

- To clarify the Hot Cell configuration before the nuclear phase, identifying ways to postpone part of the building investment, whenever it is possible and when it has an economical interest. To be noted that the delayed procurement shall no jeopardize the safety requirements nor the operation of the Hot Cell Complex before entering into nuclear phase,
- To support the ITER Beryllium Facilities Working Group, investigating different options and the related Hot Cell impact.

This activity is performed in two steps: Deliverable D1, D8 and D10.

6.2.2 Technical recommendations to reduce the building cost

Based in particular on the lessons learned of the Tokamak and other recent complex nuclear projects, the aim is to establish a list of technical recommendations for the preliminary and final design stages of the building, aiming at reducing the overall investment cost.

It corresponds in particular to recommendations for:

- the Civil Work structure,
- the Stainless Steel liner,
- the Heating, Ventilation and Air Conditioning (HVAC), including Local Air Coolers (LAC),
- the Liquid and Gas,
- the building systems (cranes, doors, trolleys, lifting platforms, etc
- the building interfaces between the building and the systems (standardization, harmonization, flexibility):
    - Permanent penetrations, refilling,
    - Temporary openings,
    - Anchorage of loads (in particular Embedment Plates),

This activity shall include series of meeting with IO, F4E representatives and sub-contractors in order to gather and formalize some of the lessons learned of the Tokamak Complex (in term of design and construction activities).

This activity corresponds to the Deliverables D2, D3, D5 and D11.

6.2.3 Specification of expected deliverables for Engineering design activities

The objective is to write a technical specification, detailing the expected deliverables related to the building design (see items listed in section 6.2.1), for the preliminary and final design of the Hot Cell Facility.

This specification shall be in line with the IO procedures and it shall take into account the TKM feedback regarding building design activities.

It shall establish:

- The list of expected deliverables,
- The scope, boundaries and a preliminary table of content of each of the expected deliverables,
- The expected level of details of each deliverable, based on lessons learned (in particular the Tokamak complex), using as much as possible some illustrations of expected documents, drawings, etc,
- The expected added value between:
    - the input data which will be provided (conceptual design stage) and the outcome of the preliminary design stage,
    - the preliminary design stage and the outcome of the final design stage,

The Technical Specification shall be clear enough to prevent the risk of having the engineering company focusing on Civil Work only, pushing the preliminary and detailed design into the procurements packages, which ends up with a major risk of later change of the building Civil Work with associated consequences in term of cost and schedule.

This activity corresponds to the Deliverables D6 and D12.

6.2.4 Review and proposed improvement of deliverables elaborated by a third party

As explained in section 6.1, an engineering activity is on-going regarding the HCC buildings design and it is broken down into 3 Work-Packages and many deliverables.

The contractor is asked to review the Civil Work aspects of the deliverables within 2 calendar weeks after reception of the documents. Each comment shall suggest a way to improve the design or the document itself.

This activity corresponds to the Deliverables D4, D7 and D9.

7 Responsibilities

7.1 Contractor's Responsibilities

In order to successfully perform the tasks in this Technical Specification, 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 IOethics, 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	Preliminary analysis Hot Cell configuration before the nuclear phase : - Identification of the HCC configuration before the nuclear phase, - Identification of potential delayed procurement, - Cost benefit analysis, - Proposed delayed procurement, cost and schedule impacts, This activity shall also support the ITER Beryllium Facilities Working Group, investigating different options and the Hot Cell impact of these options.	T0 + 1 month
D2	Technical recommendations Stainless Steel Liner (SSL) This document corresponds to the preliminary collection of requirements for SSL (including safety requirements), the preliminary design recommendations aiming at reducing the overall investment cost (which corresponds to design efforts, procurement, assembly, test and commissioning). The delayed procurement and installation shall also be investigated. Evidence shall be given that the recommendations are based on proven solutions.	T0 + 2 months
D3	Technical recommendations Building design and construction Technical recommendations aiming at standardize when possible, or at least harmonize building interfaces, developing if needed design guidance regarding: • Permanent penetrations, refilling, • Temporary openings, • Anchorage of loads (in particular Embedment Plates), The aim of this harmonization is also to gain flexibility versus later changes of the process.	T0 + 3 months

D #	Description	Due Dates
D4	Review of the deliverables WP01 produced by a third party in the frame of ITER_D_SW5UFF - Technical Specification Hot Cell Complex - Building Engineering Contract regarding Civil Work topics, with associated recommendations. Review and recommendations shall be documented based on the lessons learned of the TKM complex, reference to nuclear facilities, code of practices, standards, etc.	T0 + 4 months
D5	Technical recommendations for building construction Technical recommendations aiming at minimizing the complexity of the Building (full scope - see items given in section 6.2.2), and in the end, aiming at reducing the cost and squeezing the construction schedule.	T0 + 5 months
D6	Preliminary version of the technical specification, detailing the expected deliverables for the preliminary and final design of the Hot Cell Complex Civil Work. See section 6.2.3.	T0 + 6 months
D7	Review of the deliverables WP02 produced by a third party in the frame of ITER_D_SW5UFF - Technical Specification Hot Cell Complex - Building Engineering Contract regarding Civil Work topics, with associated recommendations. Review and recommendations shall be documented using drawings of existing systems, reference to nuclear facilities, code of practices, standards, etc.	T0+7 months
D8	Hot Cell configuration before the nuclear phase : - Identification of the HCC configuration before the nuclear phase, - Identification of potential delayed procurement, - Cost benefit analysis, - Proposed delayed procurement, cost and schedule impacts, - This activity shall also support the ITER Beryllium Facilities Working Group, investigating different options and the Hot Cell impact of these options. This version shall take into account all comments made on the previous Deliverables	T0 + 8 months

D #	Description	Due Dates
D9	Review of the deliverables WP03 produced by a third party in the frame of ITER_D_SW5UFF - Technical Specification Hot Cell Complex - Building Engineering Contract regarding Civil Work topics, with associated recommendations. Review and recommendations shall be documented using drawings of existing systems, reference to nuclear facilities, code of practices, standards, etc.	T0 + 9 months
D10	Technical recommendations Stainless Steel Liner (SSL) This document corresponds to the final collect of requirements for SSL (including safety requirements), the final design recommendations aiming at reducing the overall investment cost (which corresponds to design efforts, procurement, assembly, test and commissioning). The delayed procurement and installation shall also be investigated. Evidence shall be given that the recommendations are based on proven solutions.	T0 + 10 months
D11	Final recommendations aiming at reducing the building cost (building scope - see items section 6.2.2), which corresponds basically to the update and completion of Deliverables D2, D3, D5 and D10, all gathered together in a consistent way. Evidences shall be given that the proposed design is based on proven solutions.	T0 + 11 months
D12	Final version of the technical specification, detailing the expected deliverables for the preliminary and final design of the Hot Cell Complex Building. See section 6.2.3.	T0 + 12 months

To be noted that the priorities between the different Deliverables to be issued could be changed at the KoM or during the duration of the contract, as per IO request and in agreement with the contractor.

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:

- Report and Document Review criteria.

- Reports as deliverables shall be stored in the ITER Organization's document management system, IDM by the Contractor for acceptance.
- 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.
- The acceptance criteria of the document correspond to:
    - Justified and documented comments,
    - Lessons learned of existing nuclear facilities,
    - Reference to existing technologies and proven solutions used in nuclear field,
    - Reference to existing and applicable Norms and Standards,

10 Specific requirements and conditions

Significant experience in:

- Civil Works design of Nuclear buildings,
- Design and follow up of construction of Stainless steel liners,
- Construction and commissioning of nuclear buildings,
- Design and construction of building interfaces (Embedment Plates, penetrations, temporary openings),
- Design, construction and commissioning of building systems (HVAC, cranes, shielded doors, trolleys)

At least 20 years' experience is required in these fields of expertise.

11 Work Monitoring / Meeting Schedule

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

The main purpose of the Progress Meetings is to allow the ITER Organization/RHRM 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.

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)

CAD requirements are listed below but no CAD work is formally requested in the frame of this contract.

If 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].

16 Appendix: Main features of the Hot Cell Complex

	Requested experience	Main features of the Hot Cell Complex facilities
Nuclear civil engineering of complex large scale project	High technology project	First-of-a-kind or research construction projects
	Strong links with industry and potential Plant manufactures	Wide range of disparate leading edge/high-tech systems and equipment to be designed, in order to avoid risk of change during suppliers manufacturing design.
	International projects	ITER stakeholders are China, the European Union, India, Japan, Korea, Russia and the United States. It corresponds to 35 different nations.
	Engineering/design	Design and overall integration of : - Building structure. Volume about 300,000 m^3 nuclear concrete building - Approximately 600 rooms within the Hot Cell Complex, - Building systems, e.g. Heating, Ventilation, and Air Conditioning (HVAC), fire protection, electrical distribution, Instrumentation & Control (I&C), liners, red zone cooling, piping, - Mechanical heavy handling, e.g. cranes, doors, trolleys
Hot Cells expertise	Numbers of hot cells / red zones	15 different hot cells in HCB, in total volume of red zones / C4 ventilation class = 26,000 m^3
	Management of irradiated and contaminated components	Contact dose rate = 250 Sv/h due to activation in the Tokamak. Contamination of tritiated and activated dust on In Vessel components and IRMS Constant efforts to prevent spread of dust in red zones (from design stage to operational procedures), ALARA
	Tritiated environment	High level of tritium concentration > 4000 DAC (Derived Atmospheric Contamination) in red zones Red zone / C4 areas fully covered by stainless steel liner, with a gap between the concrete wall and the liner. This gap is maintained under air Detritiation System.
	Nuclear maintenance	10 different hot workshops, 300 m^2 average each, dealing with hands-on maintenance on components after remote decontamination, ALARA
	Remote heavy handling in red zone	Handling of various heavy components, non-exhaustive list: – Equatorial Port Plug (50t, 3.5m length x 2.4 m x 2m), – Upper Port Plug (25t, 6 m length), – Divertor (9t, 3.5m length, 2m high, 0.8m wide), – Vacuum Cryopump (2.9m length, 1.7m diameter),

	Requested experience	Main features of the Hot Cell Complex facilities
		– Oversized Neutral Beam components up to 8m length, 3m high and 3.3m wide Two lines of defence: high reliability of heavy transfer systems and mitigation means in case of unexpected load drop.
	Docking of transfer casks	Transfer and docking of Remote Handing Transfer Cask, large size docking door: 2m x 2.4m, between the TKM and the HCC, and within the Hot Cell Building.
Radwaste management	Treatment of radioactive solid waste	Orders of magnitude during 20 years operation: – 1000 tons of MAVL waste – 100 tons FMA-VC – 100 tons purely tritiated waste – 10 tons TFA
	Treatment of radioactive liquid effluent	Orders of magnitude: 200 m^3 / year
	Radwaste process remotely controlled	Type B radwaste process located in the red zones / C4 areas shall be fully remotely controlled (no man access) and with in situ remote maintenance or hands-on maintenance after remote decontamination.
Hot Cell Remote Handling	Complex remote operation	Port Plug refurbishment, example of tasks to be performed fully remotely: – tilting 90° of 50t port plugs, – removal of subcomponents, – welding and control, – testing.
	Hot Cell Remote Handling	Design and integration of: – Tens of heavy duty long range manipulators, fully powered by electrical motors, – Few telescopic power manipulators, – Shielded windows, – Lighting and viewing systems, – Frames and handling tools, Buffer storage, remote decontamination, hands-on maintenance.
	Centralized control system	Functions such as ventilation management, remote transfers, remote refurbishment of In Vessel Components, remote waste treatment, shall be controlled from a centralized control room located in the Personal Access Control Building
	Seismic requirement	High seismic requirement (2 to 3 g acceleration in different dimensions) on building structure and part of the building system and process which is seismic classified according to the safety analysis