

Annex II

Technical Specification

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for

ICH Interface Management and Design Review Documentation and Organization.

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Technical Specifications (In-Cash Procurement)

**Technical Specifications "ICH Interface Management and
Design Review Documentation and Organization"**

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and Organization"

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1 Purpose

Several Heating and Currents Drive (H&CD) systems are foreseen in ITER. The Ion Cyclotron (IC) system is part of them.

The IC H&CD shall provide radio-frequency (RF) heating and current drive to the ITER plasmas in the frequency range [40-55 MHz]. A total of 20 MW of RF power in plasma is initially required from the system. An RF heating and current drive system is composed of power sources, transmission line components and antennas that are in charge of coupling this power to the plasma. In addition, for IC system, some components are dedicated to match the impedance of the plasma to the impedance of the generator output.

The IC H&CD system is composed of the antenna port plugs, the matching systems, the transmission lines, the RF power sources, High Voltage Power Supplies, plus auxiliary sub-systems and services such as decoupling units, instrumentation and control systems (I&C), and test facilities.

The contract concerns the integration process and quality management of these systems. It is organized around 2 major topics:

- Interface Management,
- Design Review documentation and organization.

2 Scope of Work

They are two major types of activity associated to this contract:

- Interface management:

All the Plant Breakdown Structure (PBS) 51 components are "connected" to each other by functional and physical links and also "connected" to other ITER services such as cooling, power supply, buildings, etc.

This implies that the interfaces have to be described and agreed between each IC subsystem and with others PBSs.

For IC system, all components are under the preliminary or final design phase. As the designs are more and more detailed and then interface characteristics need to be defined and validated. For each subsystem design review, the level of maturity of these interface designs should be in agreement with the ITER quality Management Plan.

The PBS51 list of interfaces is described in Annex 1. An instance of one of the Interface Sheet (IS) already written and approved on ITER Documentation Management (IDM), but which still requires some work as the IC system design is progressing, is shown in Annex 2.

- Design Review documentation and organization

The design review of a sub system requires a lot of documentation management on IDM and needs to follow the design review procedure.

The contractor shall establish the list of documents to be produced and shall put the place holders in IDM. He / she shall as well take care of the implementation of the review process.

Then, he/she shall draft the notification to proceed for the design review and send the invitation to the review participants as per the Technical Responsible Officers (TRO) guidance.

The interface review is a major step of a design review and may be due before the design review. The contractor shall take care of the organisation of this interface review if required.

During the Design Review meeting, the participants can raise questions (chit forms) that shall be stored in a specific folder in IDM. For each chit an action plan will be prepared by IO TRO or DA TRO to provide an answer to the corresponding question. All information and steps will be stored in IDM: the contractor shall draft and upload all the chit documentation (question, action plan, answer) in IDM with the TRO guidance.

In order to allow a good understanding of the work associated to Design Review, the Annex3 gives an instance of notification to proceed of a previous design review and the Annex 4 is the list of document to be produced for the preliminary design review of the RF sources. The list is explicitly mentioning the reference to the design review procedure and also explains what inputs IO is expecting from DAs to get the corresponding document.

3 Definition/ References / Terminology and Acronyms

Definitions are given within the text.

For a complete list of ITER abbreviations see: [ITER Abbreviations \(ITER_D_2MU6W5\)](#).

4 Estimated Duration

The total duration of this contract shall be 1 year from the date of the Kick-Off meeting.

5 Work Description

For managing the interface documentation the contractor work shall consist in:

- Participating to all technical meeting with DAs in charge of the PBS51 component designs.
- Organising all meetings required within PBS51 team and with counterpart PBS members to update the interface data.
- Writing the minutes of the meeting
- Drafting the new interface document.
- Organising the PBS51 internal review of the document and implement any change required
- Organising the counterpart review of the document through emails and implement the required changes
- Iterate of the previous process if required

- Uploading the document in IDM respecting the ITER Quality Management Plan.

The prioritization (which interfaces to be treated/when) shall be done as per the contract RO inputs and the design review milestones.

For the design review follow up aspect, the work to be performed as described in the scope definition shall be focussed on the design reviews foreseen in the ICH system :

- The RF Source Preliminary Design Review in 2018.
- The Transmission Lines in RF (Radio Frequency) building at component level end of 2017.
- The transmission Line in RF building- Instrumentation and Control, end of 2017

For each of these design reviews, the following work shall be required:

- Establish in IDM the place holder for all Design Review documentation
- Upload as received the corresponding documents and settle the reviewers and approvers as per Design Review procedure
- Draft the IS relative to the subsystem as per at the required maturity level with the inputs of the TRO.
- Draft the Notification to proceed of the design review.
- Contact the attendees as per the list provided by the TRO to check the availability.
- Draft the agenda as per inputs from the TRO.
- Upload the presentations on IDM.
- Set up the on-line chit tool.
- Attend the design review meeting. Take notes during the meeting and assist the TROs in writing the meeting minutes.
- Follow up the design review meeting and organize the chit draft process and resolution process on IDM (draft of the chit, finalization of the chit list, follow-up of the chit resolution and associated action list and follow up of the answer validation process on IDM).

6 Responsibilities

6.1 Responsibility of ITER

ITER has the responsibility of providing detailed input data when required during the execution of the work described in §4.

Access will be granted to IDM folders to perform the tasks.

ITER shall provide offices and IT equipment at IO premises.

6.2 Responsibility of the contractor

The contractor has the responsibility of :

- regularly submitting to ITER the progress of the contract, for ITER acceptance as per §9.
- Implement the IO procedures, instruction and use the corresponding templates

7 List of deliverables and due dates

The following documents are selected as key deliverables in order to monitor the performance of the contractor but it is expected that all interface sheets and all documents which form part of the design review procedure are in the scope of the contract as per the work description. The schedule of the deliverable is not reflecting totally the work performed during the period as the contractor shall work on different topics in parallel. Indeed, the system milestones as design review dates give guidelines for these deliverables, but the interface work shall be spread within the contract period. The content of most of the deliverables is highly dependent on the design review status.

D1	TL components in RF building Final Design Review: Status of the IDM folders dedicated to the design review reflecting the work performed as per chapter 5.	T0+1 month
D2	TL I&C components in RF building Final Design Review: IDM folders dedicated to the design review reflecting the work performed as per chapter 5 created and loaded as per the DA deliveries.	T0+2 months
D3	PBS51 interfaces: Interface Overview report 1	T0+3 months
D4	PDR of the RF Source: IDM folder created and document loaded as provided by the DA and IO TRO	T0+4 months
D5	TL components in RF building Final Design Review: chit status Report	T0 +5 months
D6	PDR of the RF source: work plan for performing the interface documentation for the RF source PDR.	T0 + 6 months
D7	TL I&C components in RF building : chit status report	T0+7 months
D8	PBS51 interfaces: Interface Overview report 2	T0 + 8 months
D9	TL I&C components in RF Building: Chit status report	T0+9
D10	PDR of the RF source: Notification to proceed approved on IDM	T0+10
D11	TL Components and I&C components in RF building: Close out report	T0 + 11
D12	PDR of the RF sources: Chit status report	T0+12

In addition to the deliverables, a report on the work performed in the frame of the completion of the other deliverables shall be written by the contractor. It will allow a good follow up of the contract by the TRO and correction if required.

8 Acceptance Criteria

The deliverables as specified in Section 7 shall be accepted on the basis of their compliance with the requirements as defined in these technical specifications.

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.

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.

9 Specific requirements and conditions

The activities are done in close collaboration between IO responsible officer in ICH section and the contract responsible.

The contractor's staff will work at IO site during all the task completion but could have to participate to missions outside IO site if required by IO.

Competences in:

- interface management
- document management

10 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, the interfaces and the planning.

The main purpose of the Progress Meetings is to allow the ITER Organization/IC&LH Section and the Contractor Technical Responsible Officer 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, the ITER Organization and/or the Contractor may request additional meetings to address specific issues to be resolved.

For all Progress Meetings, a document describing tasks done, results obtained, blocking points shall be written by the contractor.

All reports will be stored in the ITER IDM in order to ensure traceability of the work performed.

11 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).

12 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.

Annex 1: List of PBS51 Interfaces

ITER_D_UL9MP7 v1.0


Annex A. PBS 51 - Status of IC H&CD Interface Documentation (ICOs & ISs)

Interface	ICM Link	Status	IC No.	Interface Short	ICM Link	IS Status	IS Review
15 - Vacuum Vessel	ITER_D_2E3B4R v3.0	Approved	15-51-001	Interface between Vacuum Vessel and IC H&CD	ITER_D_2EACD7	Approved (November 2015)	---
16 - Blanket System	ITER_D_2LAEW8 v3.0	Approved	16-51-001	Interface between Antenna Port Plug 13 & 15 and Blanket System	ITER_D_2EDWET	Approved (April 2016)	---
18 - Fueling & Wall Conditioning	ITER_D_2YMK8S v3.0	Approved	18-51-01-001	Interface between Antenna Port Plug and Gas Injection	ITER_D_2PRCXLJ	Approved (January 2015)	---
			18-51-01-001	Interface between Antenna Port Plug and Polar Injection	ITER_D_2PRG1KE	Review Required	Update 5 in IS with ICAL to remove
22 - MA & Tooling	ITER_D_2ZVMM7 v1.0	Approved	22-51-001	Interface between MA Tools and IC H&CD	ITER_D_24CSP4	Complete	Scope of PBS 22 to be reviewed
			22-51-002	Assembly of the IC port plugs on the machine	ITER_D_24Z24U	Complete	
23 - Remote Handling System	ITER_D_2ZFYH3 v3.0	Approved	23-51-001	Interface between Cask and Plug RH System and the IC Antenna Port Plug 13 & 15	ITER_D_2MEEDJ	Approved (December 2016)	---
			23-51-002	Interface between H&Z rail remote handling Equipment and the IC Antenna Port Plug 13 & 15	ITER_D_2ZGVCF	Approved (July 2017)	---
			23-51-003	Interface between Port Cell Floor Support and IC Toolstone Port Cell Equipment	ITER_D_2YWSZCW	Follows PCR 68a 1st draft ongoing	Draft of the IS sent to PBS 23 for review
26 - CC CH	ITER_D_2LQ8NG v4.2	Approved	26-CC-51-001	Interface between CCCHS and IC H&CD (Physical & Functional)	ITER_D_234JDSK	Approved (Sept 14)	Updated IS sent to PBS 26 for review. Interface interface sheet drafted (IC, IC and US regarding 24 connected ports) and multi-layers diagram
			26-CC-51-002	Interface between CCCHS and IC H&CD (Instrumentation & Control)			IS to be drafted
			26-CH-51-001	Interface between CHMS and IC H&CD (Physical & Functional)	ITER_D_2EUPEDN	Approved (May 13)	---
26-PM TCWS	ITER_D_2ZPUE4 v1.1	Approved	51-26-PM-001	Interface between IC H&CD and TCWS Functional interface with the Antenna port plug 13	ITER_D_24CDA7H	Approved (April 12)	IS updated for consistency between SRD 16 and US waiting agreement from PBS 26 on the ap
			51-26-PM-001	Interface between IC H&CD and TCWS Functional interface with the Antenna port plug 15			
31 - Vacuum	ITER_D_2Z2HKO v3.0	Waiting to be approved at ICM	31-51-001	Interface between Vacuum and Antenna Port Plug 13 & 15 Pumping services	ITER_D_2P3W2H	Under ICM review	
			31-51-002	Interface between Vacuum and TL Mobile pumping cart	ITER_D_2LWVKSL	Under ICM review	
43 - Steady State Electrical Network	ITER_D_2Y2OEG v1.0	Approved	43-51-001	Interface between Ion Cyclotron H&CD and Steady State Electrical Network Voltage Class II - Load Class IP	ITER_D_2INST27	Approved (May 2016)	---
			43-51-002	Interface between Ion Cyclotron H&CD and Steady State Electrical Network Voltage Class IV - Load Class CL	ITER_D_2P3RC4	Approved (May 2016)	---
			43-51-003	Interface between Ion Cyclotron H&CD and Steady State Electrical Network Instrumentation and Control	ITER_D_2UNELDN	Approved (March 2017)	---
44 - Cable Trays	ITER_D_2B8HMC v4.0	Approved	44-51-001	Interface between Cable Tray System (PBS 44) and Ion Cyclotron H&CD System (PBS 51) for all types of cables	ITER_D_2M3D8EP	Under ICM review - only for cables in the TMS Shop	---
45 - CODAC	ITER_D_2Z7ACDY v2.0	Approved	51-CH-45-001	Interface between IC Plant Control & Inter and Plant Operation Network of CODAC ICCH	ITER_D_2UP8WVY	Under ICM review	---
			51-CH-45-002	Interface between IC Plant Control & Inter and SDN of CODAC ICCH	ITER_D_2UPTCEQ	Under ICM review	---
			51-CH-45-003	Interface between IC Plant Control & Inter and TCN of CODAC ICCH	ITER_D_2UP4ZDC	Under ICM review	---
46 - Central Interlock System	ITER_D_2Y2H6CZ v3.2	Approved	46-51-001	Interface between Interlock System and Ion Cyclotron Heating and Current Drive system and Central Interlock System	ITER_D_2BESUP4	Approved (March 2014)	---
47 - Plasma Control System	ITER_D_2ZCQZ8 v2.0	Approved	47-51-001	Plasma Control System / IC H&CD Architecture	ITER_D_2KFZAT6	Approved (November 2016)	---
			47-51-002	Plasma Control System / IC H&CD List of signals and variables	ITER_D_2KQOCMV	Approved (January 2014)	---
48 - Central Safety System	ITER_D_2B7TCWS v3.1	Approved	48-51-51-001	Interface between IC H&CD Central Safety System (Nuclear)	ITER_D_2MYH7ZH	Under ICM review	---
			48-51-51-001	Interface between IC H&CD Central Safety System (Occupational Safety)	ITER_D_2MYH8AK	Approved (February 2014)	---
55 - Diagnostics	ITER_D_2SP7XL v2.1	Approved	51-55-51-001	Functional Links	ITER_D_2L38ALU		Draft the IS
			51-55-51-002	IC perturbation on diagnostics	ITER_D_2L34EVS		Draft the IS
			51-55-51-003	Diode and H&Z and cooling shielding plates	ITER_D_2L34EVS	Approved	---
57 - In Vessel Viewing System	ITER_D_2HSDUCB v1.0	Approved	51-57-001	Interface between In-Vessel Viewing System and Antenna Port Plug 13			Draft the IS
			51-57-002	Interface between In-Vessel Viewing System and Antenna Port Plug 15			Draft the IS
58 - Port Plug Test Facility	ITER_D_2HOCAL v2.0	Approved	51-58-001	Port Plug - Vacuum Vessel mechanical and cooling connection	ITER_D_2AP8EYH	Approved (Dec 12)	---
			51-58-002	Port Plug cooling pipe design			Draft the IS
			51-58-003	Installation sequence (IO-CA)	ITER_D_2YVMDLP	Approved (May 12)	---
			51-58-004	IC H&CD 3-D internal component geometry	ITER_D_2W8BTK	Approved (June 17)	---
			51-58-005	Emergency stop tests sequence			---
			51-58-006	Assembly tests sequence	ITER_D_2YJW3H	Approved (June 13)	---
			51-58-007	Nuclear emission	REMOVED		---

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62.11 - Tokamak Building	ITER_D_7ECABN v1.8	Approved	62.11-51-001	PBS 62-11 Tokamak Building / PBS S1 IC H&CD System Provision of Space within the Building	ITER_D_2Y7UV4	Approved (April 2016)	PCR to be raised to complete list of SIC-2 US components at port cell level; interface to be updated there as well
			62.11-51-002	PBS 62-11 Tokamak Building / PBS S1 IC H&CD System Penetration in Building Walls			
			62.11-51-003	PBS 62-11 Tokamak Building / PBS S1 IC H&CD System Support to power and plant items			
			62.11-51-004	PBS 62-11 Tokamak Building / PBS S1 IC H&CD System Cooling			
			62.11-51-005	PBS 62-11 Tokamak Building / PBS S1 IC H&CD System IC Earthing			
			62.11-51-006	PBS 62-11 Tokamak Building / PBS S1 IC H&CD System Installation, Operation & Maintenance Requirements			
			62.11-51-007	PBS 62-11 Tokamak Building / PBS S1 IC H&CD System Floor Response Spectra for seismic loadings			
62.11 BP - Blanket Plug	ITER_D_3F8X7J v1.2	Approved	62.11 BP 51-001	Blanket Plug / IC H&CD System Penetrations	ITER_D_43T4V0	Signed (No approval in IDMs)	Update the IS with the CMA Enropa reference based on the last approved CMA of blanket plug area Long term design activity - current model highly conceptual
62.13 - Assembly Building	ITER_D_2ECEY0 v2.0	Approved	62.13 to 51	PBS 62-13 Assembly Building / PBS S1 IC H&CD TL's Transmission Lines	ITER_D_2X3VZD	Approved (October 2016)	DIR of B13 Platform held on 1/3/2017 Outstanding clash platform building IC TL along N wall to be resolved without change to PBS S1 TL layout
			62.13 to 51	PBS 62-13 Assembly Building / PBS S1 IC H&CD TL's TL Penetrations to Int. Heating Bldg			
			62.13 to 51	PBS 62-13 Assembly Building / PBS S1 IC H&CD TL's TL Penetrations to Tokamak Bldg			
			62.13 to 51	PBS 62-13 Assembly Building / PBS S1 IC H&CD TL's Cooling and Air Control			
			62.13 to 51	PBS 62-13 Assembly Building / PBS S1 IC H&CD TL's H&CD controls and cabling			
			62.13 to 51	PBS 62-13 Assembly Building / PBS S1 IC H&CD TL's IC Earthing			
			62.13 to 51	PBS 62-13 Assembly Building / PBS S1 IC H&CD TL's Full H&CD IC Equipment Installation Maintenance			
			62.13 to 51	PBS 62-13 Assembly Building / PBS S1 IC H&CD TL's Floor response spectra for seismic loadings			
			62.13 to 51	PBS 62-13 Assembly Building / PBS S1 IC H&CD TL's Floor response spectra for seismic loadings			
62.21 - Hot Cell Facility Building	ITER_D_2EPR35 v1.4	Approved	62.21-51-001	PBS 62-21 HCFB / PBS S1 IC H&CD TL's Provision of space and support to equipment in the building	ITER_D_33ARWX	Approved (November 2016)	Update the IS as the layout of B21 has slightly changed
			62.21-51-002	PBS 62-21 HCFB / PBS S1 IC H&CD RF Array Feed Provision of space and support to equipment in the building			
			62.21-51-003	PBS 62-21 HCFB / PBS S1 IC H&CD Installation Operation & Maintenance			
			62.21-51-004	PBS 62-21 HCFB / PBS S1 IC H&CD Floor response spectra for seismic loadings			
63.15 - RF Building	ITER_D_2EPR35 v1.2	Approved	63.15-51-001	RF Heating Building / IC H&CD RF Sources	ITER_D_2V2WQZ	Approved (October 2016)	If load increase acceptable without building impact, update the IS if not, enhance in an acceptable weight limit on PBS S1 design.
			63.15-51-002	RF Heating Building / IC H&CD Transmission Lines			
			63.15-51-003	RF Heating Building / IC H&CD Full IC H&CD Equipment Installation Maintenance			
			63.15-51-004	RF Heating Building / IC H&CD Cooling			
			63.15-51-005	RF Heating Building / IC H&CD Controls and Cables			
			63.15-51-006	RF Heating Building / IC H&CD HV Enclosures			
			63.15-51-007	RF Heating Building / IC H&CD IC Earthing			
			63.15-51-008	RF Heating Building / IC H&CD Cooling			
			63.15-51-009	RF Heating Building / H&CD IC PS HV Power Supply Equipment			
			63.15-51-010	RF Heating Building / H&CD IC PS 27kV Switchgear			
			63.15-51-011	RF Heating Building / H&CD IC PS Full IC H&CD Equipment Installation Maintenance			
			63.15-51-012	RF Heating Building / H&CD IC PS Cooling			
			63.15-51-013	RF Heating Building / H&CD IC PS Controls and Cables			
			63.15-51-014	RF Heating Building / H&CD IC PS HV Enclosures			
			63.15-51-015	RF Heating Building / H&CD IC PS IC PS Earthing			
			63.15-51-016	RF Heating Building / IC H&CD Floor response spectra for seismic loadings			
64 - REMS	ITER_D_35LX8K v2.0	ICD updated sent to PBS S4	61-64 001	Interface between IC H&CD and REMS X Ray (functional)			Draft the IS
65.00 CA - Compressed Air	ITER_D_2EPTFH v1.2	Approved	65.00 CA 51-001	Compressed Air / Ion Cyclotron H&CD System	ITER_D_33G80Q	Approved (March 2016)	---
			65.00 CA 51-002	Compressed Air / Ion Cyclotron H&CD System			
			65.00 CA 51-003	Compressed Air / Ion Cyclotron H&CD System			
			65.00 CA 51-004	Compressed Air / Ion Cyclotron H&CD System			
65.00 HG - Nitrogen Gas	ITER_D_2ECH4X v1.2	Approved	65.00 HG 51-001	Nitrogen Gas Distribution / Ion Cyclotron H&CD System	ITER_D_33G80Q	Approved (March 2016)	PBS 65 clashes with IN and US B15-L1 PBS S1 components recently identified (S revision required position of connections)
			65.00 HG 51-002	Nitrogen Gas Distribution / Ion Cyclotron H&CD System			
			65.00 HG 51-003	Nitrogen Gas Distribution / Ion Cyclotron H&CD System			
			65.00 HG 51-004	Nitrogen Gas Distribution / Ion Cyclotron H&CD System			
66 - Radwaste T&S	ITER_D_2PHV2DG v1.0	Approved	61-64-001	Interface between Antenna Port Plug 13 and Ragwaste Treatment & Storage System			Draft the IS
			61-64-002	Interface between Antenna Port Plug 16 and Ragwaste Treatment & Storage System			
66.75 - Transport & Storage	ITER_D_354Z86 v1.0	Approved	61-66 001	Input data needed related to transport of PBS S1 systems	ITER_D_33APEB	Signed - Only for large components	---

Annex 2: Interface sheet in between PBS51 Transmission lines and PBS 51 RF sources



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Interface Sheet (IS)

IS-51.RS-51.TL-001/002/003&004

Internal IS - RF sources & Transmission Lines

Approval Process			
	Name	Action	Initiation
Author	Alexis Montemayor T.	05 May 2017: signed	IO-DG/COO-TE/DHCD/ICLH
Co-Authors	Kazarian F. Lamalle P.	05 May 2017: signed 05 May 2017: signed	IO-DG/COO-TE/DHCD/ICLH IO-DG/COO-TE/DHCD/ICLH
Reviewers	Rasmussen D.	05 May 2017: recommended (Fast Track)	ORNL - Oak Ridge National Laboratory (US)
Previous Versions	Dalbelle C. Mukherjee A. Tivoli R.	28 Apr 2017: reviewed (Fast Track) v2.3 19 Apr 2017: recommended v2.2 19 Apr 2017: recommended v2.2	US ITER (US) IPR - Institute for Plasma Research (IN) IPR - Institute for Plasma Research (IN)
Approver	Scammell B.	05 May 2017: approved	IO-DG/COO-TE/DHCD/ICLH
Document Security: Internal Use By: Zero Time			
Read Access	LG: DA RO to sign off ICDs, GG: AIF-CEA SSA Liaison Committee Members Aspects, LG: F&E-Architect/Engineering company, GG: MAC Members and Experts, GG: STAC Members & Experts, GG: CEA Decommissioning Experts, LG: CEA view, GG: DA Heads, Co-ordinators and Management, AD: ITER, AD: External Collaborator.		

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Change Log			
IS-81.83-S1.TL-001/002/003&004 (D7/NZ)7)			
Version	Latest Status	Issue Date	Description of Change
v1.0	Signed	17 Jun 2013	
v1.1	Approved	25 Nov 2013	Comments from DAAs have been taken into account.
v1.2	Approved	18 Mar 2014	- The comments from DAAs have been taken into account! • Tracking changes in the attached file.
v2.0	Signed	24 Mar 2017	Layout refined to allow for mechanical compliance between RF sources and TJs Note: - next update will include a revised set of pictures without the horizontal assembly bellows on RF source output and the corresponding ENOVIA reference. This is not an interface change since that bellows should not be included (note 1 in the document) - reference for the flange linked to a future version v2 of the interface drawing that will detail the mechanical description, without changing information contained in v1
v2.1	Signed	31 Mar 2017	- Uploaded specific document for component FLR preparation and linked it in this document - Included comments received from INDA and USCA - Removed horizontal assembly bellows from pictures - rearranged mechanical, electrical and cooling sections
v2.2	Signed	07 Apr 2017	Geometrical values filled in table 1 and 2 Skeleton reference added in section 4.2
v2.3	Signed	27 Apr 2017	Included relevant comments from earlier version
v2.4	Approved	05 May 2017	Comments from v2.3 included

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1 Purpose

This document is to define the interfaces data which will be used for the design of the both interfacing PBS.

2 Scope

The scope of this document is the interface points identified in the concerned ICD between IC RF Sources (PBS 51.RS) and IC Transmission Lines (PBS 51.TL). This Interface Sheet (IS-51.RS-51.TL--001/002/003&004) is part of the ICD [AD1]. All recommendations and updates about IS are listed in the schedule of the ICD.

2.1 Interfacing parts or components

No.	Components (PBS 51.RS)		Components (PBS 51.TL)	
	Name	Functional reference Number	Name	Functional reference Number
1		PPPPP-TTT-NNNN		PPPPP-TTT-NNNN
2				

Table to be filled when detailed design is available

3 Definitions

CMM	Configuration Model
DA	Domestic Agency
DR	Design Review
ICD	Interface Control Document
IC H&CD	Ion Cyclotron Heating & Current Drive
IN	India
IS	Interface Sheet
PBS	Plant Breakdown Structure
RF	Radio Frequency
RS	Radio Frequency Sources
SMP	Strategic Management Plan
SRD	System Requirements Document
TL	Transmission Lines
US	United States

4 References

4.1 Documents applicable to the interfacing products

Ref	Document Titles	IDM Links
[AD1]	ICD PBS 51.RS & PBS 51.TL	ITER_D_2LNMAH v3.1
[AD2]	SRD PBS 51	ITER_D_28B33K v4.3
[AD3]	ICH Drawing - 50 Ohm Flange Interface -	ITER_D_IPAG22 v2.0
[AD4]	EDH	ITER_D_2DSPT6

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[AD5]	EDH Part 4: Electromagnetic Compatibility (EMC)	ITER_D_4B523E v3.0
[AD6]	IC H&CD I&C global architecture	ITER_D_2N3NW8 v5.0

4.2 Reference Documents

Ref	Document Titles	IDMOLinks
[1]	Interface Skeleton between INDA Sources and USDA TL : GAS BARRIER INTERFACE INDA USDA#WP#UQQ6U3	n/a
[2]	Anchor Point Location for TL analysis : ANCHOR POINT FOR TL ANALYSIS#WP#UQQ7QH	n/a
[3]	Structural Analysis of ICH Transmission Line in the RF and Heating Building	ITER_D_S2KB78 v1.0

5 Interface Requirement Data

The aim of this document is to identify the interfaces between the IC RF Sources (51.RS) and the IC Transmission Lines (PBS 51.TL), and to outline the responsibilities of each of these interfaces (Figure 1).

The details of the interfaces will necessarily evolve as the design evolves. As a result, it is understood that the information provided in these sheets represents the best available information at the current phase of the design process.

Note 1: The B15 TL lay out prescribed in Mechanical layout used for determining individual loads on RF components in view of the B15 ICH TL Component FDR (UJWEQ8 v1.0) is the basis for the component design review in September 2017.

5.1 Technical Description of the Interface Points

5.1.1 Mechanical Interfaces

The physical interface location is between the US Gas barrier and the IN elbows combination directly connected to it. The flange type is described in [AD3].

The interface between RF sources and transmission lines is defined at the horizontal top flange of the Gas barrier on the vertical section connected to the switch (Figure 2). The interface locations for the gas barrier interface are provided in Table 1 according to Tokamak Global Coordinate System (TGCS). The Gas barrier and the arc detector that views the gas barriers from the US side of the barrier are part of the US DA procurement. An Assembly bellows is located below the gas barrier and allows vertical adjustment of the interface flange.

The 90° elbows combination between the interface flange and the RF output procures 3 vertical rotation freedoms that allow adjusting the connection in a horizontal plane (Figure 3). It belongs to the IN DA procurement.

It is stated in the current installation schedule that the RF sources will be installed before the TL; therefore the US DA equipment shall mate to the installed end of the elbows combination at the gas barrier. An assembly bellows in the vertical line is showed for this purpose in

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following figures 2 and 4. Note that the analysis and design documentation for this interface will not be completed by the USDA until the system FDR in 2023.

For the alignment of the interface points EN DA shall provide the positional tolerances and positional accuracy (in next version) to US DA. The position design of the interface flange is provided in the TGCS.

The mechanical anchorage for the transmission line at the RF source shall be designed as fixed in all six degrees of freedom. The mechanical anchorage locations are provided in Table 2 according to the TGCS.

Intersystem forces between INDA TL and USDA TL require iterations until forces are accepted or force convergence is obtained. The initial nodal forces and anchor forces are in ITER_D_S2KB78 v1.0. The anchor point at the INDA Source is defined in Table 2.

Table 1 Gas Barrier Interface Locations

Source	Gas Barrier Interface Location		
	Tokamak Building Coordinates ^{1,2}		
	X	Y	Z
1	35649.81	-70782.53	14485.00
2	39099.81	-70782.53	14485.00
3	42899.81	-70782.53	14485.00
4	47149.81	-70782.53	14485.00
9	50599.81	-70782.53	14485.00
5	54049.81	-70782.53	14485.00
6	58649.81	-70782.53	14485.00
7	62099.81	-70782.53	14485.00
8	65549.81	-70782.53	14485.00

1. The location of the component is based on the Placement Coordinate System provided in AD3.
2. The flange (X-Y plane) of the Placement Coordinate System shown in [AD3] is to be oriented parallel to the X-Y plane of the TGCS.

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Table 2 Anchor point location for TL analysis

Source	Tokamak Building Coordinates		
	X	Y	Z
1	35300.00	-72000.00	13570.00
2	38750.00	-72000.00	13570.00
3	42200.00	-72000.00	13570.00
4	46800.00	-72000.00	13570.00
9	50250.00	-72000.00	13570.00
5	53700.00	-72000.00	13570.00
6	58300.00	-72000.00	13570.00
7	61750.00	-72000.00	13570.00
8	65200.00	-72000.00	13570.00

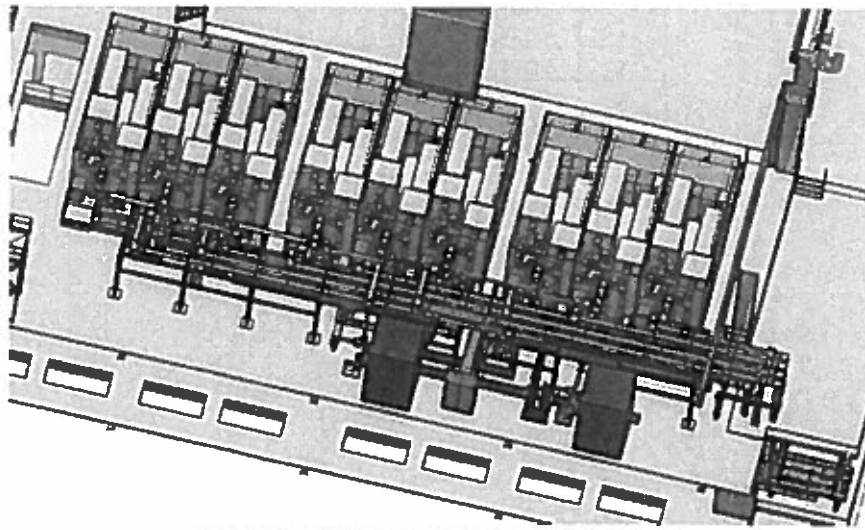


Figure 1. Transmission Lines and RF Sources in the RF building L3

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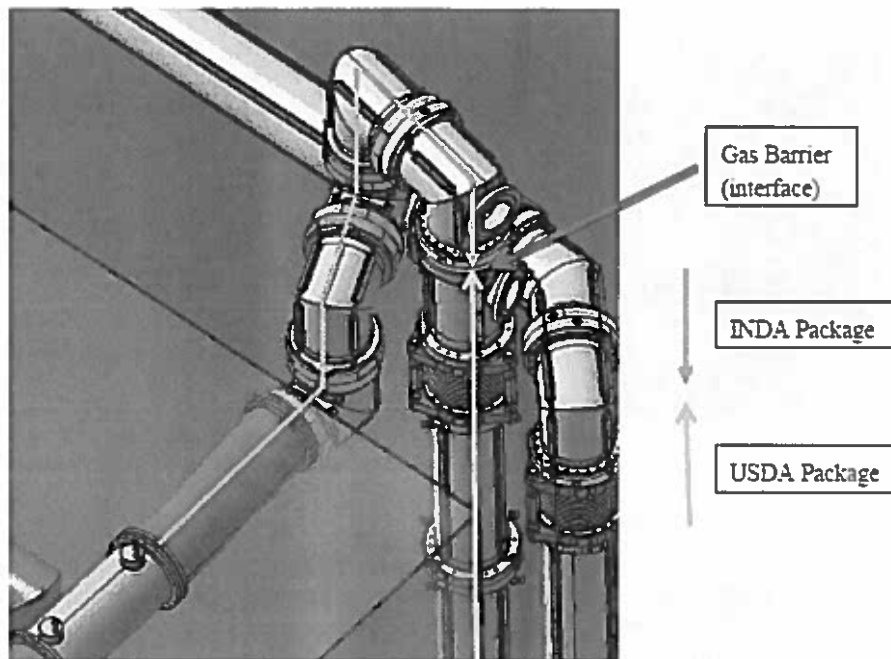


Figure 2: Interface location between Transmission Line and one RF Source in RF Building L3

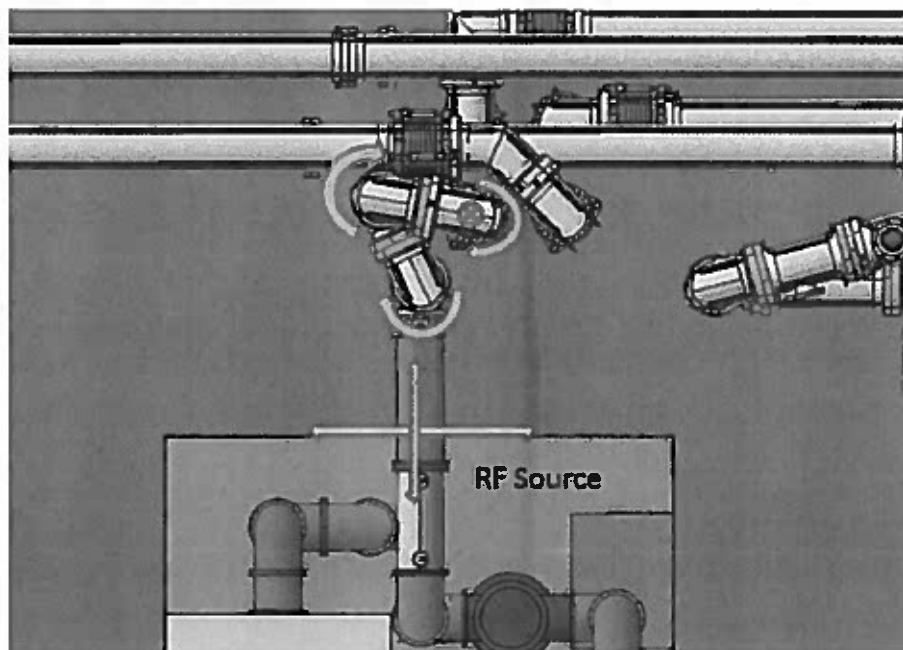
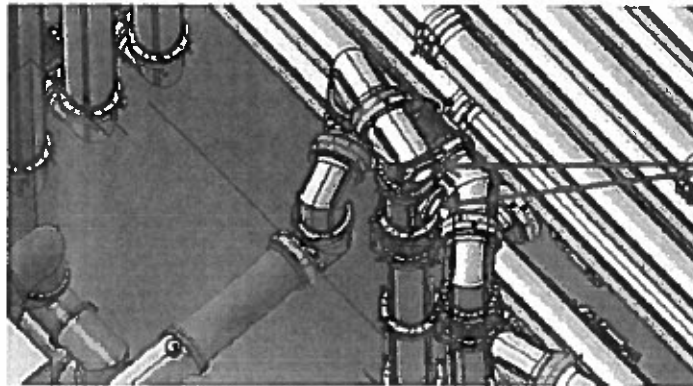


Figure 3: horizontal assembly compliance provided by elbows rotation

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Gas cooling
each side of
GB

Figure 4: gas cooling is provided by respective D.A. on each side of the interface flange

5.1.2 Electrical Interfaces

The grounding for the transmission lines is done as per the guidelines of the Electrical Design Handbook [AD4]. Some examples can be found in the EDH Part 4: Electromagnetic Compatibility (EMC) section 8.2 [AD5].

Electrical RF continuity is provided on both inner and outer conductors of coaxial lines.

The bi-directional coupler (located inside the RF source) output signals are split and made available to both the IN and US I&C systems. US I&C system will connect on a patch panel located near the RF output on the face of RF source enclosure. The RF connection will always be terminated by a matched 50 ohm load, either provided by the cable to USDA I&C system or by a matched termination provided by ENDA mechanically linked to the panel.

5.1.3 Gas Cooling Interface

There shall be no gas flow sharing between RF Sources and TL.

The cooling system and dynamic/static pressurisation system from RF source up to the interface point are procured by the EN DA (Fig. 4). ENDA gas line tie in at the gas port is not to affect the structural integrity of the transmission line.

The center conductor temperatures at the gas barriers are to be limited to 150 C maximum at the gas barrier.

5.1.4 Water Cooling Interface

There shall be no water cooling flow sharing between RF Sources and TL.

5.1.5 Mechanical Interlocks

The mechanical interlocks will be defined by IO as per the operation procedure. The definition of the operation procedure is to be described (IDM reference TBD).

5.1.6 Instrumentation & Control

A simplified functional breakdown for IC H&CD plant system is described below:

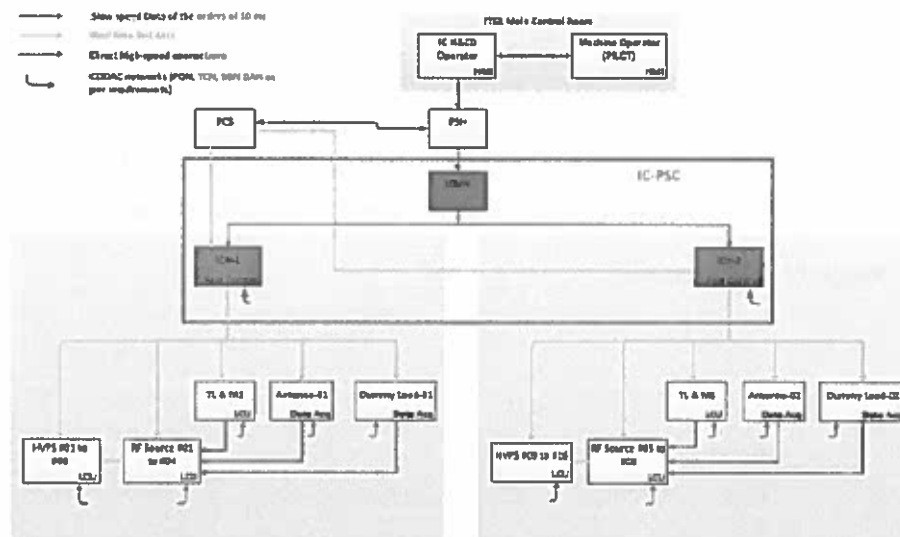


Figure 5 ICH&CD I&C functional architecture showing control hierarchy [4D6]

The complete description and requirements on I&C are in the IS between RF Sources and IC-PSC and the IS between TL and IC-PSC.

6 Interface Step Status (Achieved Maturity Level)

Interface Points	Initial Allocation	Refined Allocation	Final Allocation
Interface location	X		
Flange design	X		
Interfacing parts or components	X		

Annex 3: Example of Notification to proceed for a PBS51 Transmission Line design review



DM LID
RVWEJS

VERSION CREATED ON / VERSION / STATUS
15 Oct 2015 / 1.1 / Approved

EXTERNAL REFERENCE / VERSION

Authorizations and Permits

! IC H&CD Transmission Line Radio Frequency Building Preliminary Design Review - Notification

Design Review Notification

Approval Process			
	Name	Action	Justification
Author	Rasmussen D.	22 Oct 2015: signed	
Co-Author	Alonso Montemayor T.	15 Oct 2015: signed	IO-DG-COO/TED/HCD/TEC
Reviewers	Beaumont B.	23 Oct 2015: recommended	IO-DG-COO/TED/HCD/TEC
	Bollson D.	05 Nov 2015: recommended	IO-DG-COO/TED/HCD
	Hernandez D. *	02 Nov 2015: recommended	IO-DG-COO-CIO/CMD
	Lamalle P.	23 Oct 2015: recommended	IO-DG-COO/TED/HCD/TEC
	Onozuka M.	16 Nov 2015: recommended	IO-DG-COO-CIO
Approver	Alekseev A.	16 Nov 2015: approved	IO-DG-COO/TED
Document Security: Internal Use			
RO: Lamalle Philippe			
Read Access:	LG: Transmission Lines IO PA project team, LG: Transmission Lines DA PA project team, LG: Transmission Lines IO PARO, LG: Transmission Lines IO PSRO, LG: Transmission Lines IO QARO, LG: Transmission Lines IO TRO, LG: Transmission Lines IO SRO, LG: IEM section leader, LG: hearings, LG: Transmission L...		

PDF generated on 14 Nov 2015

DISCLAIMER: UNCONTROLLED WHEN PRINTED - PLEASE CHECK THE STATUS OF THE DOCUMENT IN IEM

Change Log			
IG HA&CD Transmission Line Radio Frequency Building Preliminary Design Review - Notification (RVWEJS)			
Version	Latest Status	Issue Date	Description of Change
v1.0	In Work	14 Oct 2015	
v1.1	Approved	15 Oct 2015	Typo

ITER_D_RVWEJ5 v1.1



NOTIFICATION OF THE IC H&CD SYSTEM PRELIMINARY DESIGN REVIEW:

5.1.P2.US.01.1 IC H&CD TRANSMISSION LINE SYSTEM IN THE RF BUILDING

PBS 51 TL RF

Type of PA: Functional Requirement

PA signature date: 30 April 2010

DW'S Design Approval milestone: 24 March 2016

Announcement of the Design Review:

Complies with the Design Review Procedure (2832CF) v3.2

According to Template: ITER_D_D2D57E v2.1

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1. DATE, TIME AND VENUE

Date	From 7 December 2015	To 8 December 2015
Time	EU (Cadarache) GMT	
Venue	ITER Organization, Route de Vinon sur Verdon – 13067 St Paul Lez Durance – France	



2. OBJECTIVES

The main goals of the System PDR are to check that:

1. The selected design solution definition is still meeting the technical objectives of the systems requirements.
2. The interface specifications are consolidated.
3. The design solution definition planned to be justified in a consistent way.
4. The manufacturability, transfer, assembly and qualification/start-up of the system have been addressed.
5. The operation principles of the system within the ITER overall plant are defined.

This Preliminary Design Review (Design Review 4) is held as a scheduled milestone in the development of the IC H&CD Transmission Line (TL) System. Its scope covers the ICH TL configuration and components on L3 and L2 of RF Building-15. This PDR is necessary to allow components to be delivered by the IO need date. Its corresponding FDR will follow late in 2016.

The scope of this PDR consists of generic 50 ohm transmission line straights and elbows (see Figures 1-3), 4-port switches (Figure 4), 3 MW test loads, pressurized blowers (Figure 5) and other specialty components along with the support structure (Figure 6) in the RF Building. The scope of the PDR also includes the Instrumentation and Control associated with all these components. The components are needed to facilitate early testing of the prototype RF Source from the INDA and the following RF sources. The transmission lines comprise the major part of all ICH deliverables. The same 50 ohm transmission line design will be used in the Tokamak Building-11 Gallery and the Assembly Building-13.

The requirements and design choices will be examined and justified. Design justification, including dimensions, cooling strategy, assembly issues, and materials, will be covered along with test results. Four choices of inner conductor insulating supports were considered. The selection of the final design will be presented (Figure 7).

The PDR will demonstrate that:

- The RF Building configuration and functional description meets the ITER requirements.
- The design is sufficiently complete and justified to initiate the steps for the production of relevant prototype components in preparation for an FDR.
- The R&D process for qualifying the components is thorough and consistent.
- The manufacturability, transfer, assembly, and installation of the components meet stakeholders' expectations.
- The component support structural forces and load specifications are within allowable limits.
- A plan to order two 3 MW loads that are being tested at INDA and modified for ITER will provide the necessary load for testing in conjunction with prototype source delivery.

ITER_D_RVWEJS v1.1



- Maintainability and operability are sufficient and integrated with overall ITER controls.
- Instrumentation and Controls P&ID and PFD drawings are complete to the PDR level.

After the PDR, 100 meters of transmission line test articles (straights and elbows and additional components) will be fabricated for use at the US ITER Test Facility (Figures 8, 9) to refine assembly and installation procedures and to greatly facilitate arc localization studies. The main difference between this short run and the following ITER production will be fewer QA welding inspections and no IO approvals of the MIP and QA plan. Operational experience with the test facility will also enable subsequently updated assembly and human factors documents to be accurate and detailed.

Reference documents:

- SRD-51 ICH and CD from DOORS, ITER_D_28B33K v4.3.
- Ion Cyclotron Heating and Current Drive (ICH and CD) Subsystem Design Description Document (sDDD), ITER_D_CVZYVA v4.0.

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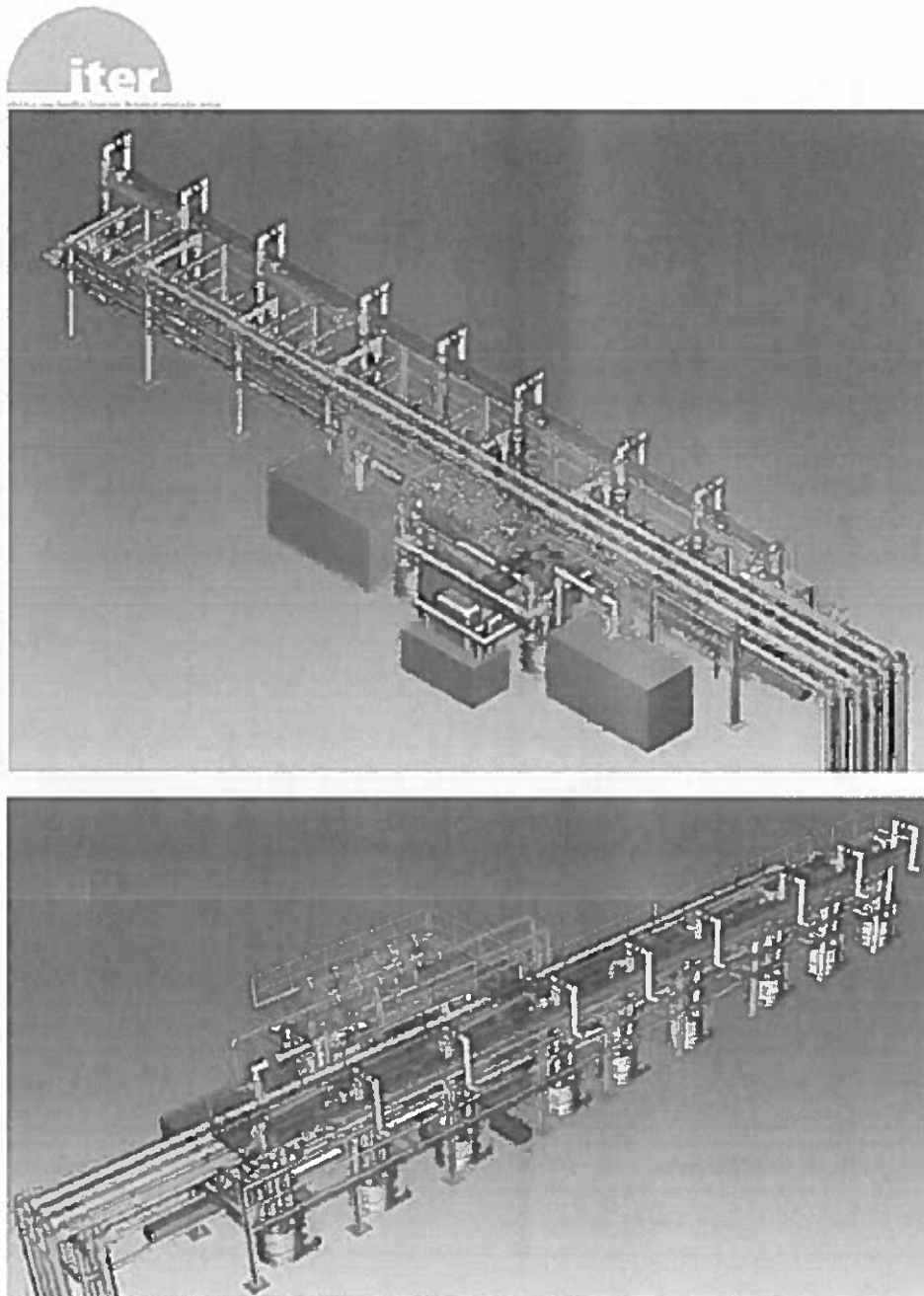


Figure 1: Views of US-supplied ITER equipment in the RF Building. Not shown are the RF sources.

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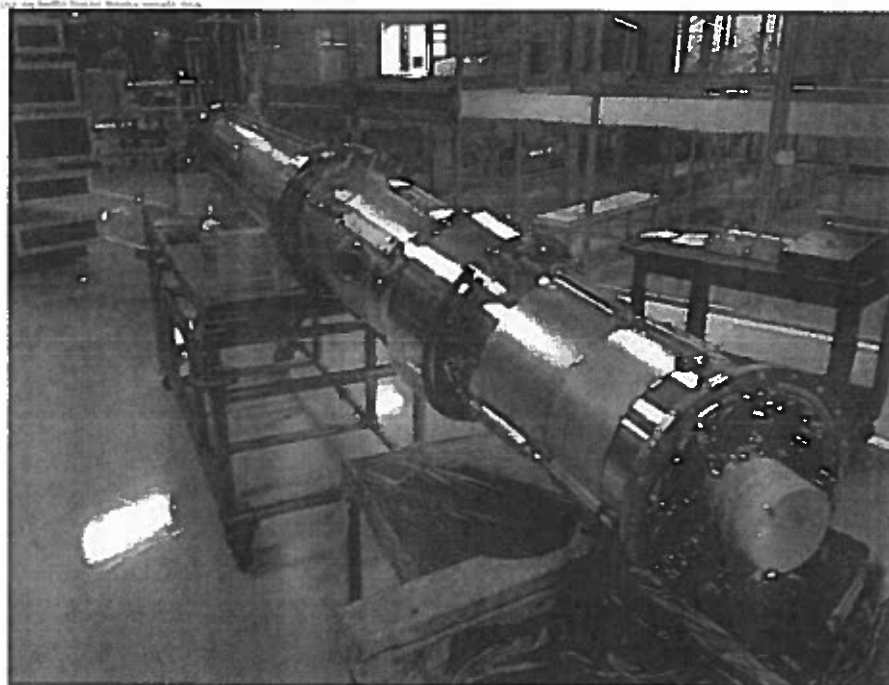


Figure 2: Transmission line straight and elbow test article undergoing factory acceptance.

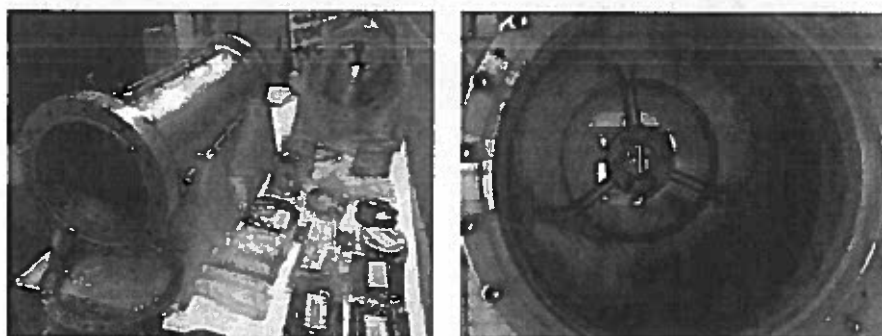


Figure 3: Transmission line straight and elbow test article undergoing US ITER Test Site acceptance.

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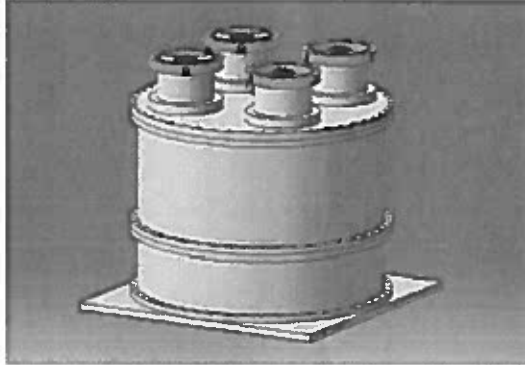


Figure 4. Model of 4-Port Switch. Eleven switches will be used in the RF Building.

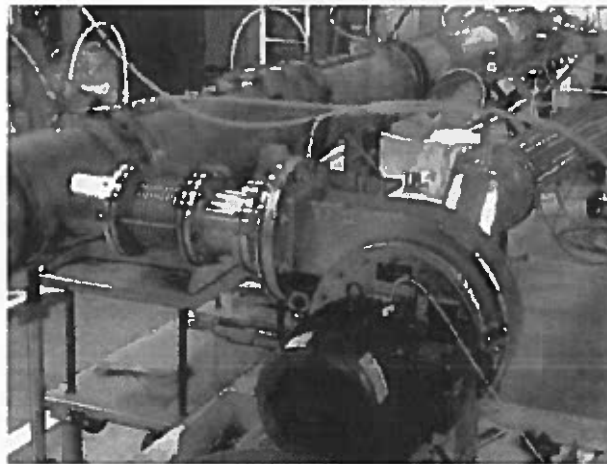


Figure 5. Pressurized Blower for TL internal cooling.

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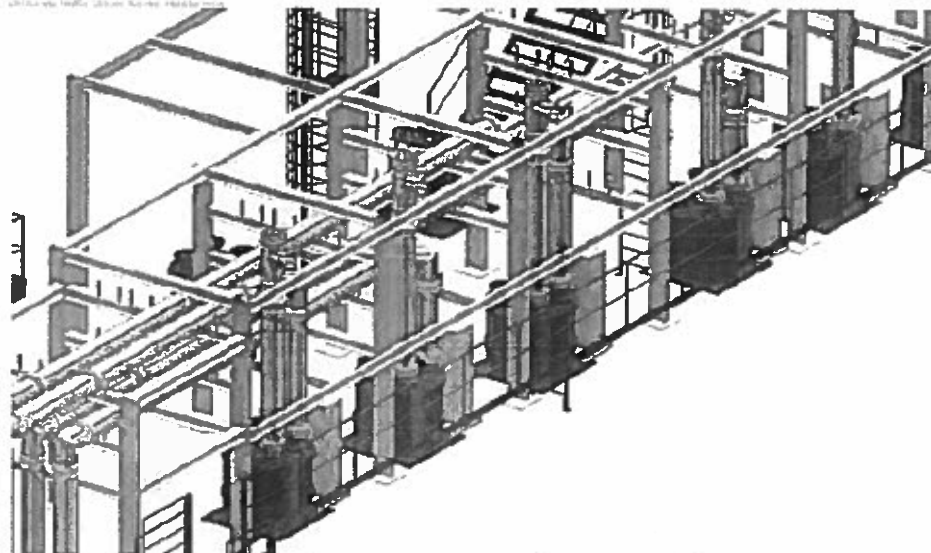


Figure 6: RF Building transmission line support structure

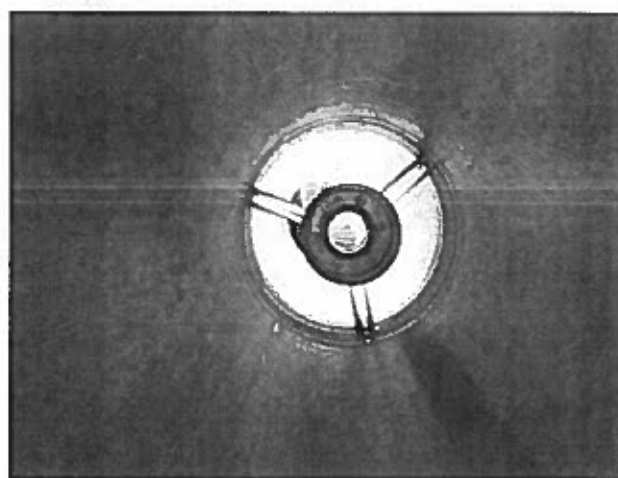


Figure 7: Choice of TL inner conductor supporting insulator design

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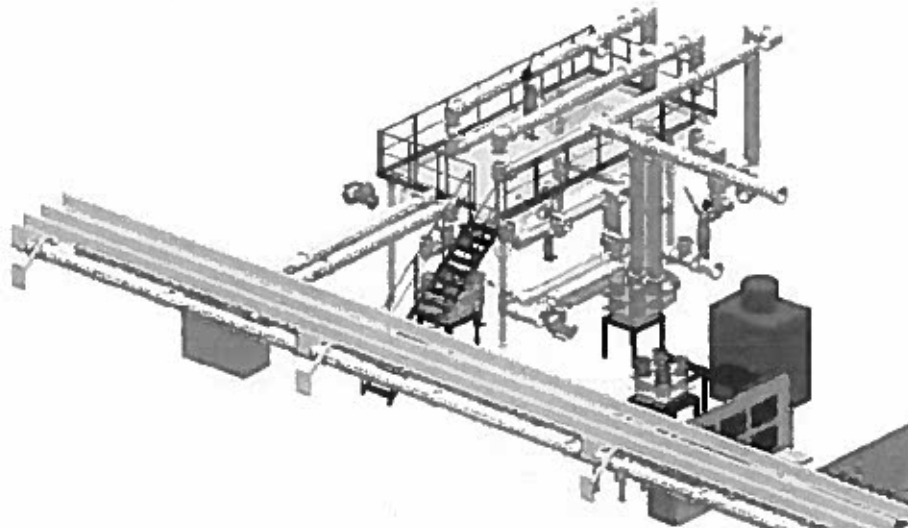


Figure 8: US ITER ICH Test Stand with 100 meters of transmission line and component test articles



Figure 9: US ITER Test Stand Resonant Ring for high power (6 MW) component testing. Not shown are the 50 ohm and 20 ohm resonant lines for high voltage (80 kV) and high current (>900 A RF) measurement. An 80 meter resonant line extension is under construction.

ITER_D_R1WEJS v1.1



3. SCOPE

Concerned System: 5.1.P2.US.01.1 IC H&CD Transmission Line System in the RF Building

3.1 QC and SIC of the SSC System, Structure or Components and Services

PBS Item	Safety Class	Quality Class
50 ohm coaxial transmission line straights and elbows	Non-SIC	QC2
4-Port switches	Non-SIC	QC2
3 MW test (dummy) loads	Non-SIC	QC2
Pressurized blowers and piping	Non-SIC	QC2
Support structure and specialty components	Non-SIC	QC2
Instrumentation and control equipment	Non-SIC	QC2
All other transmission line components structures and service connection items in Figure 1	Non-SIC	QC2

3.2 Main/Critical Aspects To Be Assessed during the Review

Aspect	Yes	No
Performance	X	
Design Integration	X	
Nuclear Safety		X
Manufacturability	X	
Installation scheme	X	
Testing	X	
Operation and maintenance	X	
Decommissioning		X

4. INPUTS

Status of chits and actions of previous Design Reviews can be found at [51 TL - IC H&CD Transmission Line Gallery Components PDR \(ITER_D_J89FEF\)](#). The following subset of chits is associated with the IC H&CD Transmission Line System in the RF Building.

Chit No.	Status	IDM Nos. (Issue / Answer)	Title
1	Closed	6TAMEE / QSUBNE	CCWS water lines / Steel
8	Closed	L56QF9/QF8SMD	Nitrogen filling of Penetrations
9	Closed	KXFZBN / KR3DLB	Brass in water lines

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Chit No.	Status	IDM Nos. (Issue / Answer)	Title
13	Closed	KXRGWB / PMKJH9	Assembly Bellows / Compliance
16	Closed	F7L42X / PNLQKV	cat 1 – DCM
18	Closed	L5HSBV / Q797CE	Interface Sheets
19	Closed	FZU28U / PNNGZ4	PFD, P&ID, C&ID
20	Closed	HPYCW5 / LXNUED	Assembly Safety
21	Closed	L8CX7C/PNWJN3	cat 1 – Stress Analysis / Structural Integrity
24	Closed	KZCPAG / PAYWK3	Gas Blower Reliability
25	Closed	4556XR / PASTU7	Safety Factors for Glass Rods
29	Closed	HLM7J7 / PNUUKT	Assembly, Disassembly, Maintenance Plan
32	Closed	K75TUN / PJ2EPF	cat 1 – Human Factors
33	Closed	FQGZ28 / PNXXFL	RAMI Availability Quota
35	Closed	L8DBV6 / PMEM5G	Standardization of TL
36	Closed	L8E4DC / PAYYHY	Maximum Voltage on Gallery TL
28	Open	GL3WHZ / PNVSGL	R&D Reports
31	Open	JV53FP / QRHSLD	I&C Sensor Strategy

The PDR data package presented to the review can be found at [ITER_D_RZ9ASU](#).

5. LIST OF STAKEHOLDERS

All the stakeholders shall have view access on the technical package as well as on the E-chit application ([RWF9PS](#)).

5.1 Panel Members

Workflow to be applied (Full [A], simplified [B]): **B**

According to [ITER_D_N662N8 - Design Review Plan for 2014](#), **type C**

OFFICIAL REVIEW PANEL MEMBERS		
Name/ E-Mail	ROLE	UNIT
Patrick Mollard Patrick.Mollard@cea.fr	Chairperson (4)	CEA
Francois Arnould Francois.Arnould@iter.org	Nuclear Safety, Licensing & Environmental Protection Division representative	SQS
Patrick Vertongen Patrick.Vertongen@iter.org	Quality Assurance Division representative	SQS/QA

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Matteo Gilardi Matteo.Gilardi@iter.org	Occupational Health & Security Coordination Division representative	SQS
Miikka Kotamäki Miikka.Kotamaki@iter.org	Project Engineering and Integration Division representative	COO/CIO/DN
Ken Blackler or Brian Macklin Ken.Blackler@iter.org or Brian.Macklin@iter.org	Assembly and Operation Division Representative	AOP
TBD	Technical Experts (5)	IO or external
Aparajita Mukherjee or Rajesh Trivedi aparajita.mukherjee@iter-india.org or rajesh.trivedi@iter-india.org	Interface DA Representative	IN DA

The Panel composition shall be tuned to the applied Workflow (Full or Simplified) (see ITER_D_2832CF - Design Review Procedure) and reminded hereafter.

Panel experts/representatives	Full Workflow [A]	Simplified Workflow [B]
Review Chair (Chairperson) (4)	M	M
Nuclear Safety [SQS (SRO)]	M	M
IO/QA Division	M	O (M if QCI)
IO/ Occupational Health & Security	M	M
IO/Integration [CIE]	M	O
IO/Assembly & Operations	M	M
IO/Main Interfacing System Representatives	O	O
IO/I&C	O	O
Other Technical Experts (1)(5)	M	M
Concerned DA (2)	O	O
CEA expert (3)	O	O

M = Mandatory participation

O = Optional participation (people shall be informed and can decide to participate to the review or being part of the Panel). Whatever their decision they should be distributed documents and given possibility to issue Chits.

(1) Design Approver may decide additional participation to the Review Panel. However it is advisable to limit additional participation to a minimum in order to reduce the cost.

(2) Prior to the PA, for systems to be procured in-kind, a representative of each DA in charge of the procurement appointed by the affected DA Head.

(3) "As the result of an agreement between IO and the Host Country, CEA experts are designated by the Agence ITER-France Director or representative to participate in the design reviews. The CEA experts or their representatives can make recommendations to IO regarding decommissioning and

ITER_D_RVWEJS v1.1



raise issues whenever necessary. The decision to implement these recommendations or address these issues is IO's responsibility."

CEA's people shall be systematically:

1. notified and distributed all the administrative documents related to the Review (notification, agenda, etc...)
2. given access to all the documents presented to the review and to the design documents category 1, 2 and 3 indicated in the DR procedure appendix B [this can be done in granting "view access" to your folders and daughter folders to the Global Group GG: CEA Decommissioning Experts]
- (4) Patrick Mollard is chargé d'affaires for the upgrade of the Tore Supra ICRH system in the framework of the WEST project.
- (5) Add a brief resume for each external expert showing its related area of competence.

5.2 Distribution List

In addition to the panel members, the approved notification will be distributed to following persons:

PEOPLE TO BE INFORMED		
Name/E-Mail	Role	Unit
Dave Rasmussen and Mike McCarthy rasmussenda@ornl.gov and mccarthymp@ornl.gov	Design Developers	ORNL
Bertrand Beaumont Bertrand.Beaumont@iter.org	IC H&CD System Responsible Officer	TED/HCD/IEC
Alexander Alekseev Alexander.Alekseev@iter.org	Design Approver Head of Directorate	TED
Deirdre Boilson Deirdre.Boilson@iter.org	Design Coordinator Head of Division	TED/HCD
Sabine Grangier Sabine.Grangier@iter.org	Travel and Logistics	HCD
Giulio Sannazzaro Giulio.Sannazzaro@iter.org	Systems Engineering, Analysis and Standards Section Leader	PSE/PEI/SEAS
Alain Guigon Alain.Guigon@iter.org	Design Review Manager	DIP/CCD
David Heroguez David.Heroguez@iter.org	Design Review Administrator	DIP/CCD_EXT
Tania Alonzo Tania.AlonzoMontemavor@iter.org	Design Review Support	HCD/IEC_EXT
Philippe Lamalle Philippe.Lamalle@iter.org	Design Review Secretary (TRO for the IC H&CD Transmission Lines)	HCD/IEC

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Annex 4: List of PBS51 RF source documentation

ITER_D_UASMKF v1.0

IC and LH system interfaces and quality management
Contract Number - HQ/LJ/4300001081

DELIVERABLE 9

ITER SOLUTION P

Introduction

The scope of this deliverable is to list the documentation required from IN DA for the RF Sources PDR. This document tries to clarify as much as possible the information expected in each of the documents.

PDR Documentation

Document Type	Maturity at Preliminary Design Phase	Document Description	Write Progress	Comments	Deliverables/References	ISSUE DATE
System Requirements Document (SRD)	Complete with external updates	SRD shall be completed for all requirements not previously provided. In particular, the applicable list of codes and standards shall be updated to take the entire applicable to the manufacturing phase into account if they have not been identified before.	NO			ITER_D_20834C - SRD S1 (Approved)
Interface Control Document (ICD)	Complete	Interface consistency with design progress of interfacing systems is necessary.	NO			ITER_D_21040A - IC Interface Folder
Interface Sheet (IS)	Complete/defined	Complete set of interface sheets is required. All IS shall be created. Interface sheets are confirmed with IEC. All physical interfaces between systems and IEC/ITER are specified, and system operation updated.	IC/IN DA			ITER_D_21040A - IC Interface Folder
Configuration Management Model Block (CMMB)	Complete/defined	Interface consistency with design maturity level.	IC/IN DA		ITER_D_21040A - CMMB (Approved)	
System Design Description (SDS)	Complete/defined	<p>System of Purpose: Selection and Description of the reference solution (system and main components).</p> <p>The goal of the SD phase is to detail the selected solution sufficient to enable the relevant authority to take the decision to go to the next phase of the Design where changes will increase the cost dramatically.</p> <p>At this stage, the general architecture is consolidated and the main sub-systems described adequately.</p> <p>The level of detail varies for each system or component depending on the risk analysis. The design solution definition shall be developed until the required risk can be measured (i.e. identified and quantified).</p> <p>To be updated consistently with design maturity level.</p> <p>Design Description: The selected solution is developed. The maturity of the definition of the system is sufficient to present the description of the design. Physical architecture of the system. Integration of the design of the component sub-systems. Allocation of specifications to the sub-systems. Definition of the interfaces specifications between sub-systems. Identification of critical components based on a risk analysis.</p>	IN DA	<p>System overview - Background - Performance specifications.</p> <p>Design level for RFPS system - Preliminary configuration - System design - Modeling & simulation.</p> <p>Sub-systems/Component description & specifications.</p> <p>Low power RF - High power RF - Power supplies - Transmission line components & wiring - Distributed elements - Cables - RF structure - Mechanical items.</p> <p>1. Final complete system specification, performance, interface, acceptance test procedures.</p> <p>1. To check all the technical specifications for the components directly linked to the system.</p>	<p>ITER_D_20424AA v1.2 - Procedure for the preparation, review and approval of the SDSs.</p> <p>ITER_D_21040A v1.0 - Sub-System Design and Component Design - CMMB (Approved)</p>	
System Functional Analysis	Complete	<p>Basic function behavior is exhaustively described in all operating states of the plant/system including maintenance, abnormal including transient/accident events.</p>	IN DA	<p>The Functional Analysis is required for the Risk Analysis. The Functional Analysis of the System is required for the Preliminary Hazard Analysis. The Operational Analysis.</p>	<p>ITER_D_20834C - ITER SAM ANALYSIS PROGRAM</p> <p>ITER_D_21040A - PHS S1: SAM analysis of ITER (Approved)</p>	
System Load Specification	Complete	<p>The load specification shall be updated to take the current design of the system into account. Load specification shall be updated during normal operation and during transient/accident events.</p> <p>Loads that directly do not cause any feasibility issue are not required at this stage of the design.</p>	IN DA	<p>Reference to the analyses performed to define the load specification (normal, transient, etc.) shall be provided.</p> <p>The System Load Specification is the basis of the Structural Integrity Report of a system and all of its components which have to verify that the chosen structural design is able to withstand all loads.</p> <p>It is to update the new load as it is (for the design) required (up to 1.25x).</p> <p>Loads from S are included.</p>	<p>ITER_D_21040A - Guidebook for ITER System Load Specification</p> <p>ITER_D_21040A - Preparation of the System Load Specification</p> <p>ITER_D_21040A - Load Specification S1</p> <p>ITER_D_21040A - Load and System Load Specification</p> <p>ITER_D_21040A - Guidebook for Structural Integrity Analysis</p>	
System Detailed Performance Definition	Preliminary	<p>The feasibility of main performance specified for the system shall be verified.</p> <p>The main expected performance from SDS of each operating state, during normal operation and transient/accident events, shall be verified and checked with relation to the architecture and systems selected for the system (in particular all performance having any impact on the system overall architecture).</p> <p>All expected performance shall be taken into account in the SD. A preliminary assessment of the system shall be prepared, defining a preliminary allocation of performance to sub-systems/components.</p> <p>Comments:</p> <ul style="list-style-type: none">- At PDR level, this assessment of main performance should be based on preliminary simulations, preliminary calculations, data from return of experience of similar systems.- The assessment requirement shall be clearly identified and updated as the SDS is necessary.	IN DA	<p>System overview - Background - Performance specifications.</p> <p>These calculations should not only use data from the system itself. Responses from other systems or from ITER (global functioning) studies should be needed.</p> <p>These values should not be based only on the worst case (normal) case (for ex: a system where it is not necessary to consider the worst case, or calculations, and for component / design).</p> <p>At PDR level, during the PDR, the comparison of the load specification with the system load is necessary to check the feasibility of the design.</p>	<p>ITER_D_21040A v1.0 - Sub-System Design and Component Design - CMMB (Approved)</p>	
Process Flow Diagram (PFD)	Complete with normal updates	<p>Interface consistency with design maturity level.</p> <p>Comments:</p> <ul style="list-style-type: none">- PFDs are detailed in PDS and CSD to identify all components down to level of component / system.	IN DA	<p>During PDR phase, PFD is defined down to level of component / system.</p> <p>Comments are not identified in PDS (lower level), but in PFD (higher level) is necessary.</p>	<p>ITER_D_21040A - CAD Manual 11 - Diagram Definition</p> <p>ITER_D_21040A - Plant Diagram Test Specification</p> <p>ITER_D_21040A - ITER Planting System for Plant Components</p>	
Detailed Diagram (PDS, SLD, piping, tubing)	Complete	<p>All Detailed Diagrams are produced consistently with design maturity level.</p> <p>Plant Diagrams: PDS are produced in a level of detail consistent with the Preliminary Design maturity, allowing the identification of all the components necessary to clearly understand the process.</p> <ul style="list-style-type: none">- The Main Features of the components (e.g. construction pressure)- Exchange between systems/sub-systems/components- Input/output flow direction- The location of components (room), and penetrations. <p>Electrical Diagrams:</p> <ul style="list-style-type: none">- Detailed SLD are required- Preliminary version of Cabling Diagrams (consistently with design maturity level) - cables, penetration represented (at least at high and medium voltage cables)- Preliminary version of Binding Diagrams consistent with Preliminary Design studies (at least at high and medium voltage cables)- All diagrams showing the full plant of the component	IN DA	<p>ITER_D_21040A - CAD Manual 11 - Diagram Definition</p> <p>ITER_D_21040A - Plant Diagram Test Specification</p> <p>Electrical Diagrams:</p> <p>ITER_D_21040A - Cable Engineering scope and definition</p> <p>ITER_D_21040A - Electrical Diagram Test Specification</p> <p>ITER_D_21040A - ITER Planting System for Plant Components</p>		
Control and Instrumentation Documents (CIS)	Preliminary	<p>The Control and instrumentation diagrams shall be produced. The list of IEC engineering data shall include:</p> <ul style="list-style-type: none">- Plant system IEC architecture- Plant system components performance and configuration- List of inputs and outputs (I/O) of the IEC components- List of the Process Variables handled by the plant system IEC components- Configuration of IEC sub-systems	IN DA	<p>Sub-systems/Component identification & specifications</p> <p>For the PDS (ITER_D_21040A)</p>	<p>ITER_D_21040A - Methodology for PDS IEC specifications</p> <p>ITER_D_21040A - PDS Protocol for IEC Diagrams</p> <p>ITER_D_21040A - Plant Control Design Handbook</p> <p>ITER_D_21040A - Plant Control Design Handbook</p> <p>ITER_D_21040A - CAD Manual 11 - Diagram Definition</p>	

ИТЕХ_Д_КАСМЕТ v1.0

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