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VERSION CREATED ON / VERSION / STATUS
13 Dec 2022 / 2.1 / Approved

EXTERNAL REFERENCE / VERSION

Technical Specifications (In-Cash Procurement)

Technical Specification for PBS 62-11-BP Bioshield Plug Final Design

Technical Specification for Final Design Finalization of PBS 62-11-BP Bioshield Plugs

Contract to be issued in the frame of PCR 1333 implementation

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1 Purpose.

This document is a technical specification for the design finalization of Bioshield Plug system at level B1, L1 and L2 of ITER Tokamak building (building B11).

Design finalization means in achieving a level of maturity of the system design good enough for passing the Final Design Review (FDR) gate according to ITER System Design Process [1].

The Bioshield Plug system is fully described in §2.

Scope of work is fully detailed in §3.

Contract to be issued in the frame of IO Project Change Request PCR 1333 implementation.

2 System description.

The Bioshield Plugs (BPs) are considered as a sub-system of the concrete building and more precisely of subsystem of the ITER Tokamak building. BP main function is to reconstitute the biological shielding function of the bioshield wall at the level of the openings of the various machine ports. The BPs are located within the Tokamak building inside Port Cells (PCs) and the Neutral Beam (NB) cell with the exception of the equatorial (L1) level of the NB Cell (see Figure 2-1).

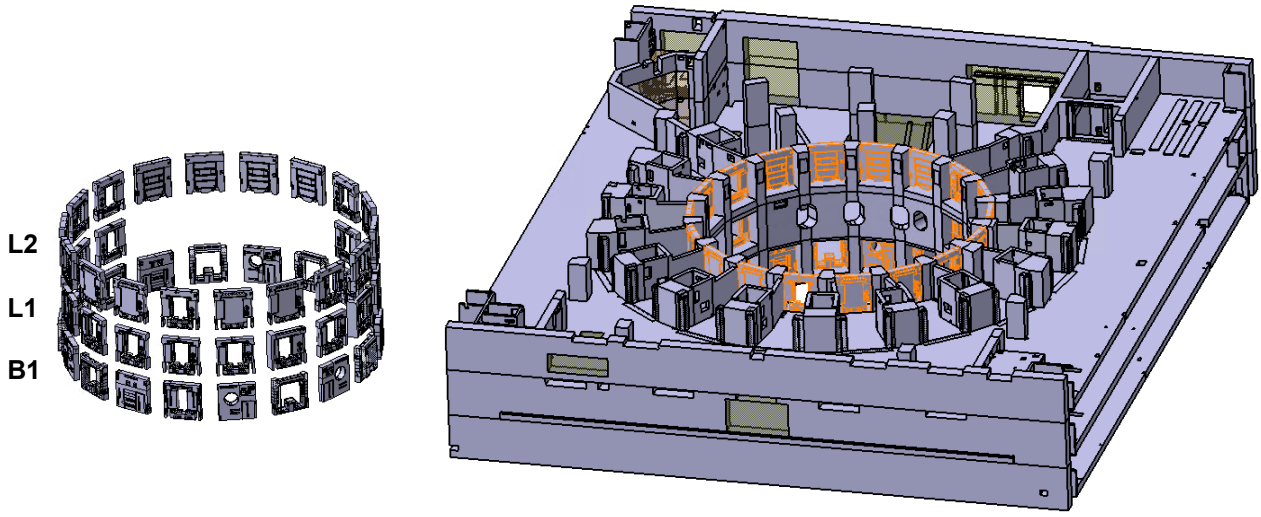

Figure 2-1 BPs general view

A Bioshield Plugs (BPs) system concept design was developed by ITER Organization (IO) between May 2021 and Jan 2022 for all 50s BPs. No.3 Concept Design Review Data packages are available as input for developing the scope of the present contract as described in the following chapters.

2.1.1 BPs Concept Design Review (CDR) No.1

CDR-1 covers a total of 26 BPs at equatorial (L1) and Upper Level (L2) as below:

Table 1 BPs CDR-1 scope

Build Level	GBS	Parts of the Bioshield Plug
11-L1	11-L1-C01	Equatorial Port Bioshield Plug *Peripheral part including Butterfly Doors* *(Central Part belongs to PBS 55.Qx or PBS 52.00)*
	11-L1-C02	
	11-L1-C03	
	11-L1-C08	
	11-L1-C09	
	11-L1-C10	
	11-L1-C11	
	11-L1-C12	
	11-L1-C14	
	11-L1-C17	
	11-L1-C16	TBM Port Bioshield Plug *Peripheral part including Butterfly Doors* *(Central Part belongs to PBS 56)*
	11-L1-C18	
11-L2	11-L2-C01	Upper Port Bioshield Plug *Peripheral part including Butterfly Doors* *(Central Part belongs to PBS 55.Ux)*
	11-L2-C02	
	11-L2-C03	
	11-L2-C08	
	11-L2-C09	
	11-L2-C10	
	11-L2-C11	
	11-L2-C14	
	11-L2-C17	
	11-L2-C18	
	11-L2-C12	ECH Port Bioshield Plug *Peripheral part including Butterfly Doors* *+ Removable Central Part* *(for maintenance of EC Upper Port system)*
	11-L2-C13	
	11-L2-C15	
	11-L2-C16	

Design focus of two representative cases:

- **TBM Equatorial Port 16 (11-L1-C16)**
- **ECH Upper Port 16 (11-L2-C16)**

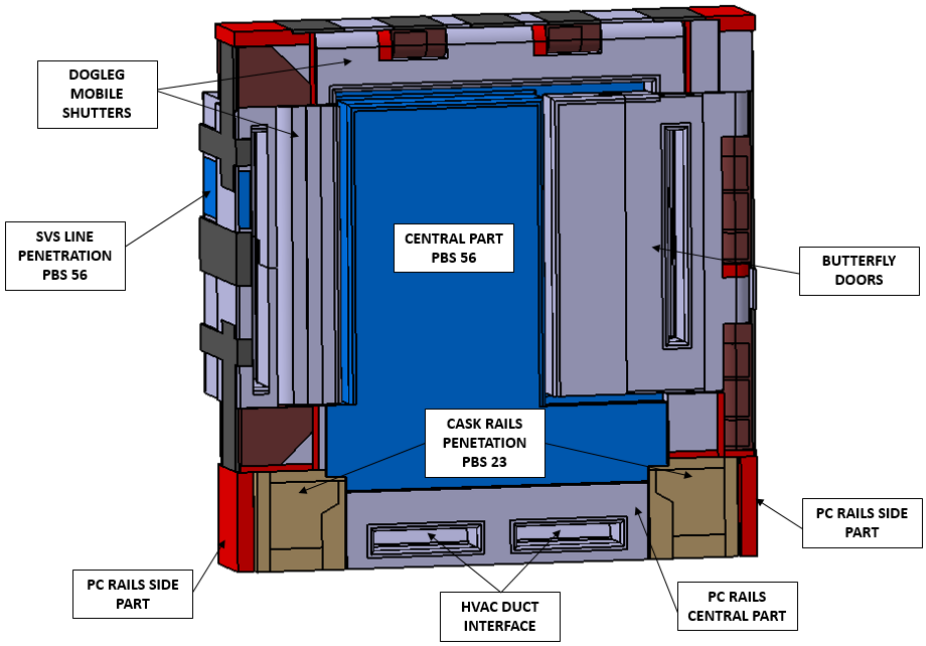

Figure 2-2 TBM Equatorial Port 16 (11-L1-C16)

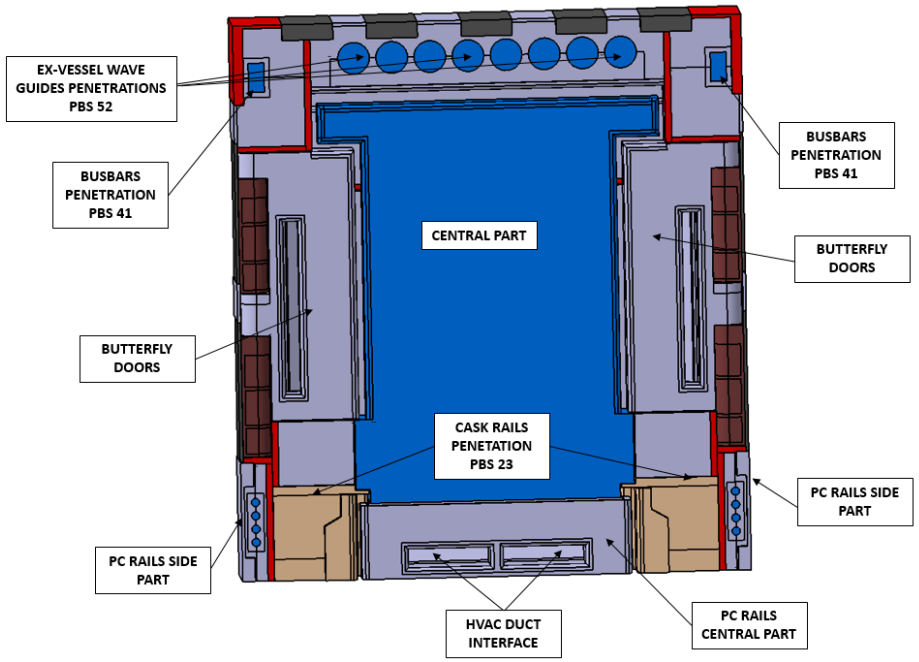

Figure 2-3 ECH Upper Port 16 (11-L2-C16)

CDR-1 Data package is summarized here below:

Table 2 BPs CDR-1 Data Package

Document Id.	Description	Ref.	Notes
01	Design Compliance Matrix (DCM)	[2]	Safety requirements propagation and design compliance
02	System Design Description Document (DDD)	[3]	Design drivers detailed design description
03	Functional Analysis	[4]	Same for CDR-1, CDR-2 and CDR-3
04	3D CAD models (detail models of representative cases and configuration models of rest)	-	CAD model to be provided via DET process at KoM (See § 10)
05	Structural calculation	[5]	
06	Shielding calculation	[6]	
07	Computational Fluid Dynamic calculation	[7]	Same for CDR-1 and CDR-2
08	Bill Of Material (BOM)	[8]	

2.1.2 BPs Concept Design Review (CDR) No.2

CDR-2 covers a total of 12 BPs at lower (B1) level as below:

Table 3 BPs CDR-2 scope

Build Level	GBS	Parts of the Bioshield Plug
11-B1	**11-B1-C01**	Cryostat Ports *Peripheral part including Butterfly Doors and removable central parts*
	11-B1-C07	
	11-B1-C13	
	11-B1-C02	Remote Handling (RH) Ports *Peripheral part including Butterfly Doors (Central Part belongs to PBS 55.Lx)*
	11-B1-C08	
	11-B1-C14	
	11-B1-C03	In-Vessel Viewing Ports *Peripheral part including Butterfly Doors*
	11-B1-C05	
	11-B1-C09	
	11-B1-C11	
	11-B1-C15	
	11-B1-C17	

Design focus of three representative cases:

- **Cryostat Port C01 (11-B1-C01)**
- **RH Port C02 (11-B1-C02)**
- **IVV Port C11 (11-B1-C11)**

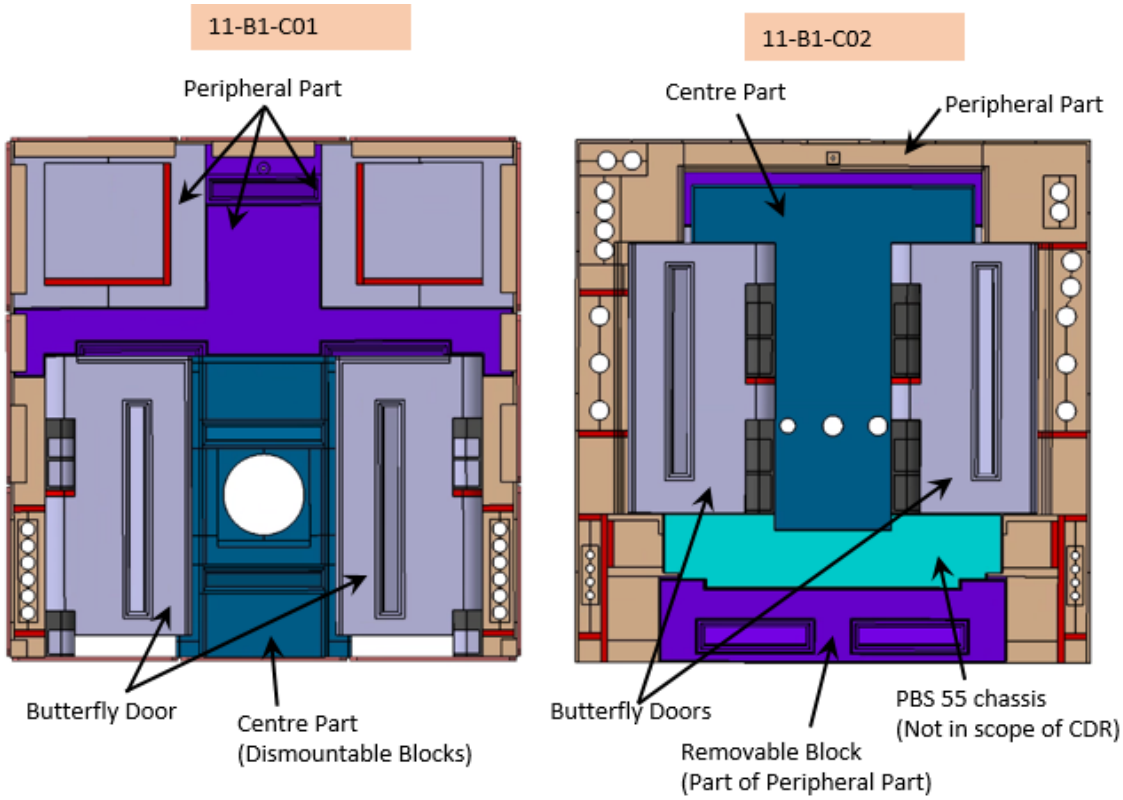

Figure 2-4 Cryostat Port C01 (11-B1-C01) and RH Port C02 (11-B1-C02)

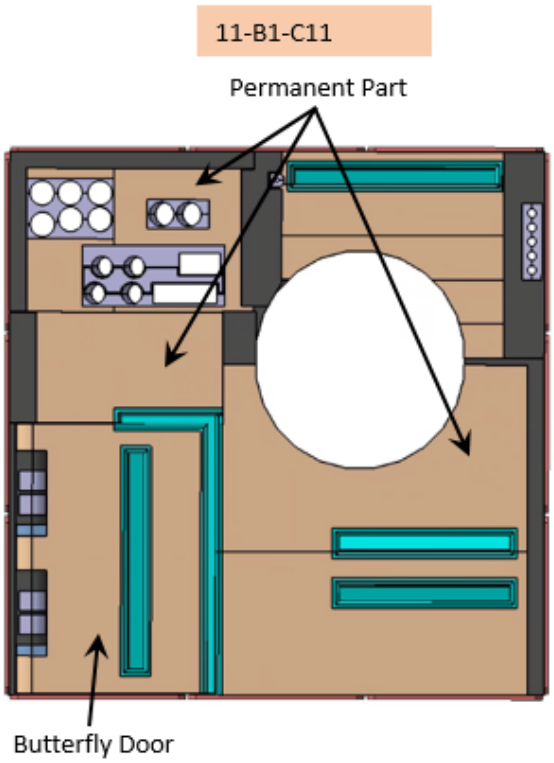

Figure 2-5 IVV Port C11 (11-B1-C11)

Table 4 BPs CDR-2 Data Package

Document Id.	Description	Ref.	Notes
01	Design Compliance Matrix (DCM)	[9]	Safety requirements propagation and design compliance
02	System Design Description Document (DDD)	[10]	Design drivers detailed design description
03	3D CAD models (detail models of representative cases and configuration models of rest)	-	CAD model to be provided via DET process at KoM (See § 10)
04	Structural calculation	[11]	
05	Shielding calculation	[12]	
06	Bill Of Material (BOM)	[13]	

2.1.3 BPs Concept Design Review (CDR) No.3

CDR-3 covers a total of 12 BPs at lower (B1), equatorial (L1) and NB Cell Upper Ports as below:

Table 5 BPs CDR-3 scope

Build Level	GBS	Parts of the Bioshield Plug
11-B1	11-B1-C04	Cryopump Ports *Peripheral part*
	11-B1-C06	
	11-B1-C10	
	11-B1-C12	
	11-B1-C16	
	11-B1-C18	
11-L1	11-L1-C13	ICH Ports *Peripheral part and butterfly doors* *(Central Part is in charge to PBS 51.MS)*
	11-L1-C15	
11-L2	11-L2-01 Upper Port 04	NB Cell Upper Ports Bioshield Plug *Peripheral part and RH removable shielding blocks*
	11-L2-01 Upper Port 05	
	11-L2-01 Upper Port 06	
	11-L2-01 Upper Port 07	

Design focus of three representative cases:

- **Lower Cryopump Port C12 (11-B1-C12)**
- **Equatorial ICH Port C15 (11-L1-C15)**
- **NB Cell Upper Port 07 (11-L2-01 Upper Port 07)**

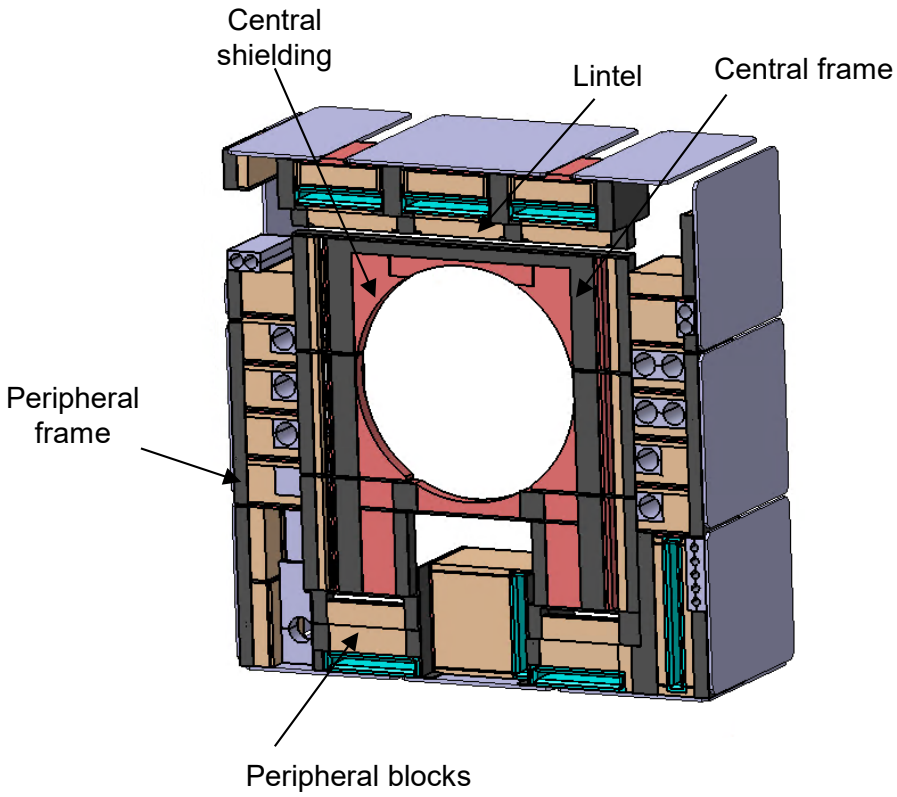

Figure 2-6 Lower Cryopump Port C12 (11-B1-C12) alternative model [14]

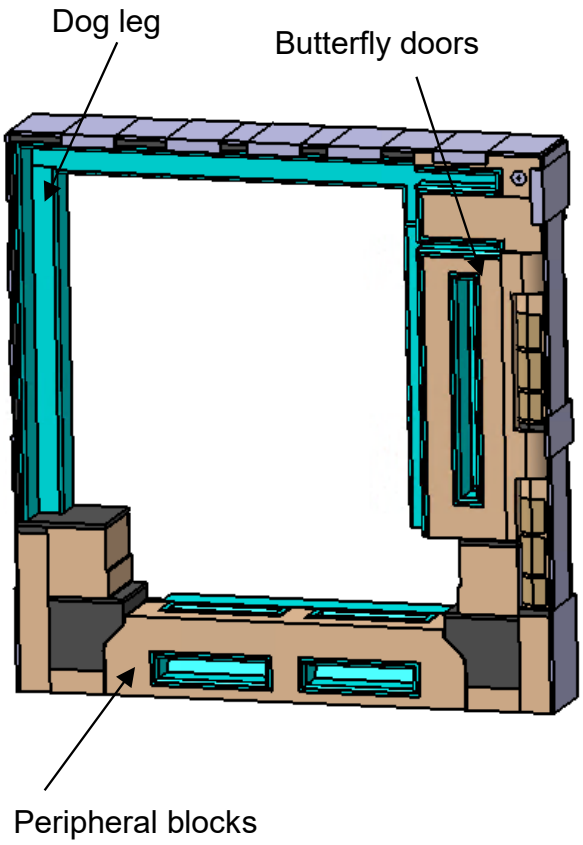

Figure 2-7 equatorial ICH Port C15 (11-L1-C15)

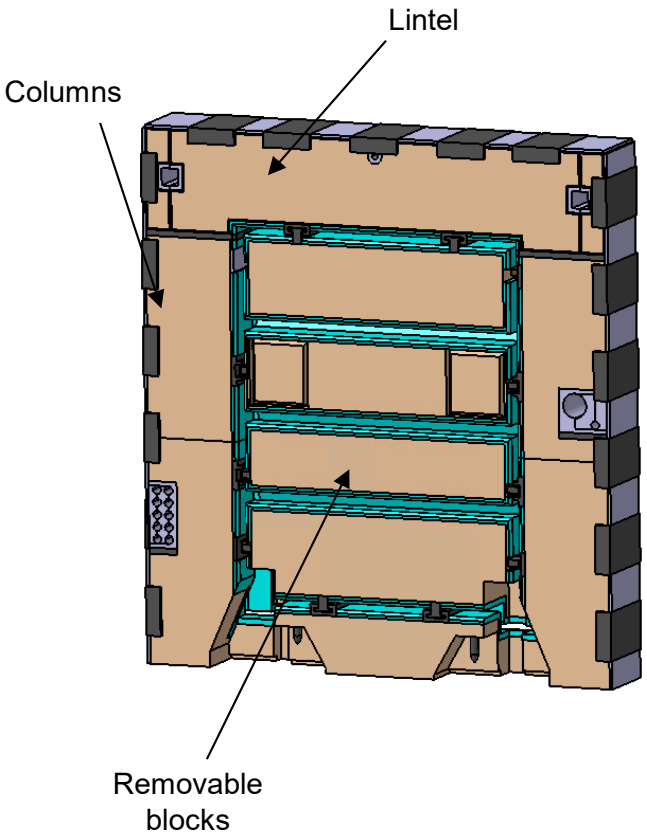

Figure 2-8 NB Cell Upper Port 07 (11-L2-01 Upper Port 07)

Table 6 BPs CDR-3 Data Package

Document Id.	Description	Ref.	Notes
01	Design Compliance Matrix (DCM)	[15]	Safety requirements propagation and design compliance
02	System Design Description Document (DDD)	[16]	Design drivers detailed design description Alternative model for Lower Cryopump Port C12 (11-B1-C12) included in [14]
03	3D CAD models (detail models of representative cases and configuration models of rest)	-	CAD model to be provided via DET process at KoM (See § 10)
04	Structural calculation	[17]	
05	Shielding calculation	[18]	
06	Computational Fluid Dynamic calculation	[19]	
07	Bill Of Material (BOM)	[20]	

2.1.4 BPs Captive parts/components

The so called captive parts/components are indeed parts/subsystem with the highest priority being linked to the installation sequence of the ITER machine for the First Plasma.

Bioshield Plugs captive parts are shown below for Port Cells levels B1, L1 and L2 and for NB Cell Upper Ports. See also reference in [21].

At conceptual level, materials for captive parts are in summary (See also relevant design requirement in § 4):

- Intermediary plates for connecting the bioshield to building Embedded Plates are in Stainless Steel (SS304);
- Any support and filler plates or adjustment plates are same in Stainless Steel (SS304);
- Shielding blocks are conceived in Stainless Steel box (10mm thick) filled in with Borated Heavy Concrete (SS304+BHC);
- Neutron absorber materials (borated silicon/boron carbide) are used around penetration and dog-legs;
- Sleeves for piping crossing bioshield are conceived in Stainless Steel (SS304).

2.1.4.1 Lower (B1) Ports Cells

- **B1 Cryostat Ports (C01, C07, C13)**

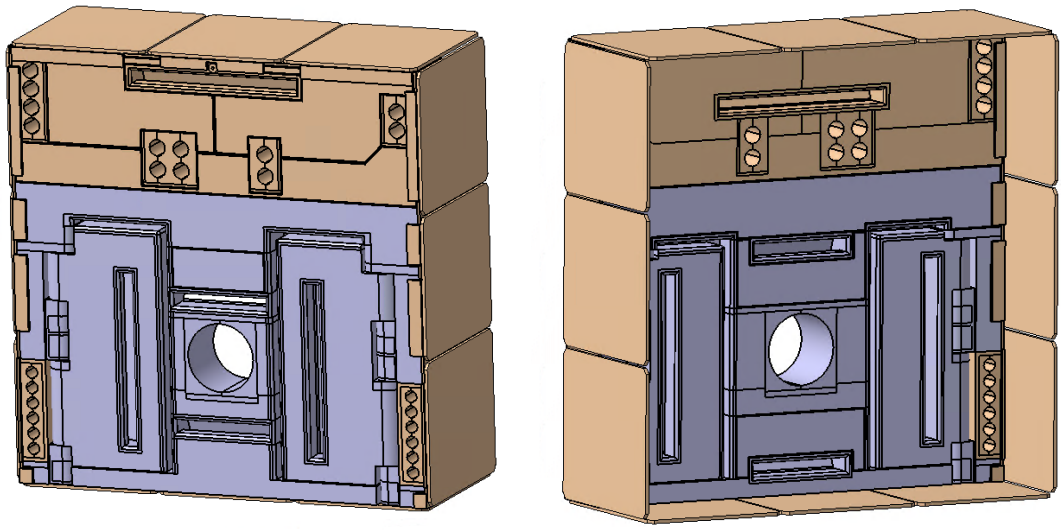

Figure 2-9 B1 Cryostat Ports BPs Captive Parts (in yellow) general views

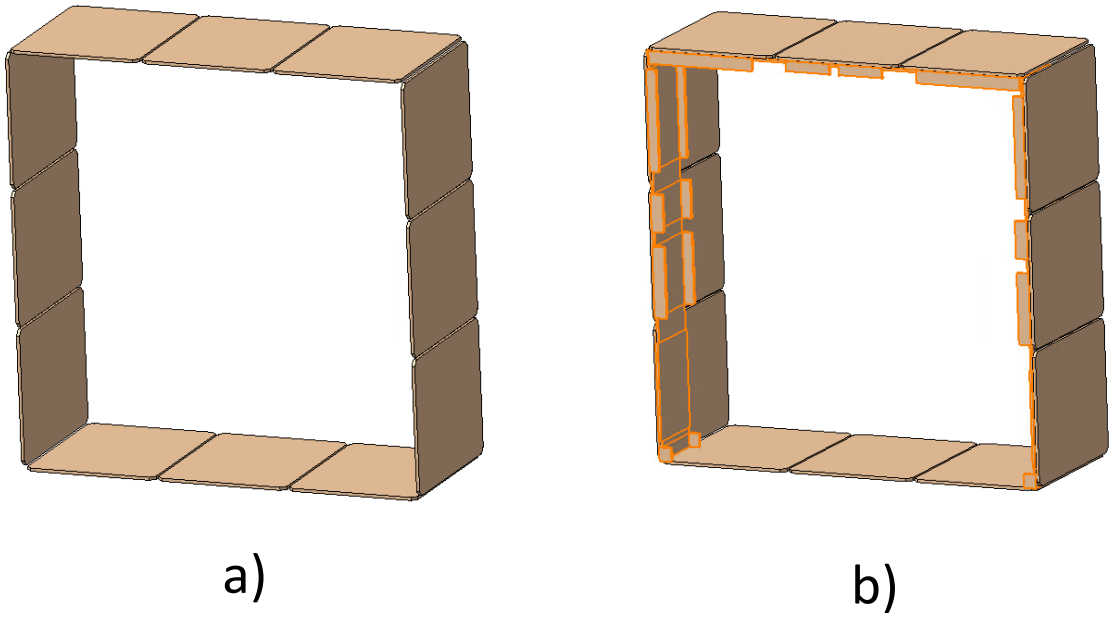

Figure 2-10 a)Intermediate plates b)Support plate plus filler plates

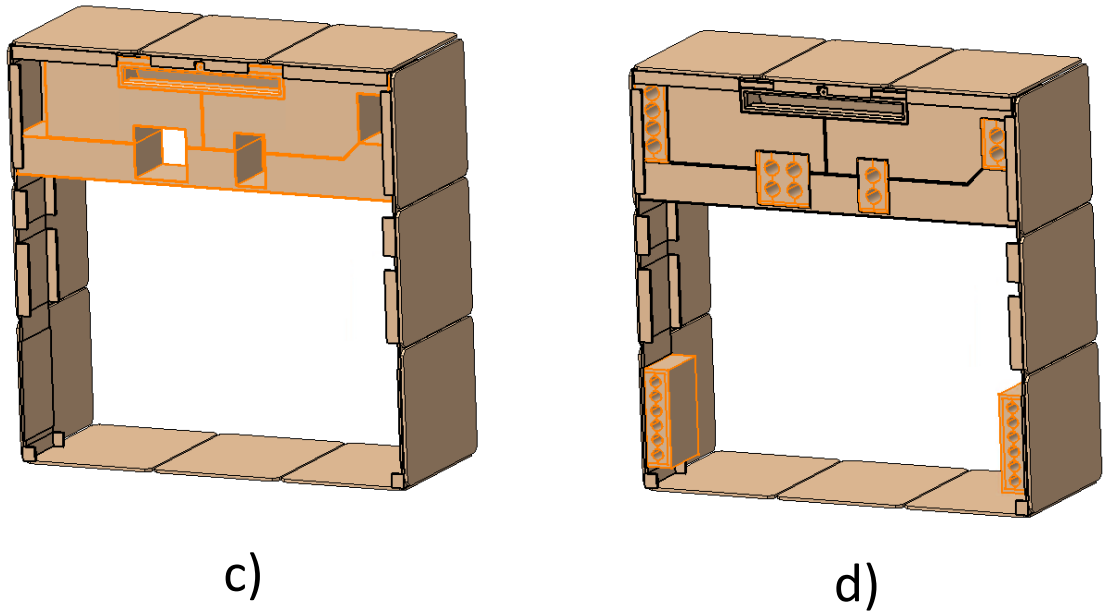

Figure 2-11 c)Lintel shielding blocks d)Pipes sleeves plus adjustment plates

Captive parts indicative mass total 21 tons (around 49% on BP total mass of 42.5 ton):

- **Intermediate plates (SS304):** 5.8 tons
- **Support and filler plates (SS304):** 1.8 tons
- **Lintel shielding blocks (SS304+BHC):** 8.7 tons
- **Sleeves and adjustment plates (SS304):** 4.7 tons

- **B1 Remote Handling Ports (C02, C08, C14)**

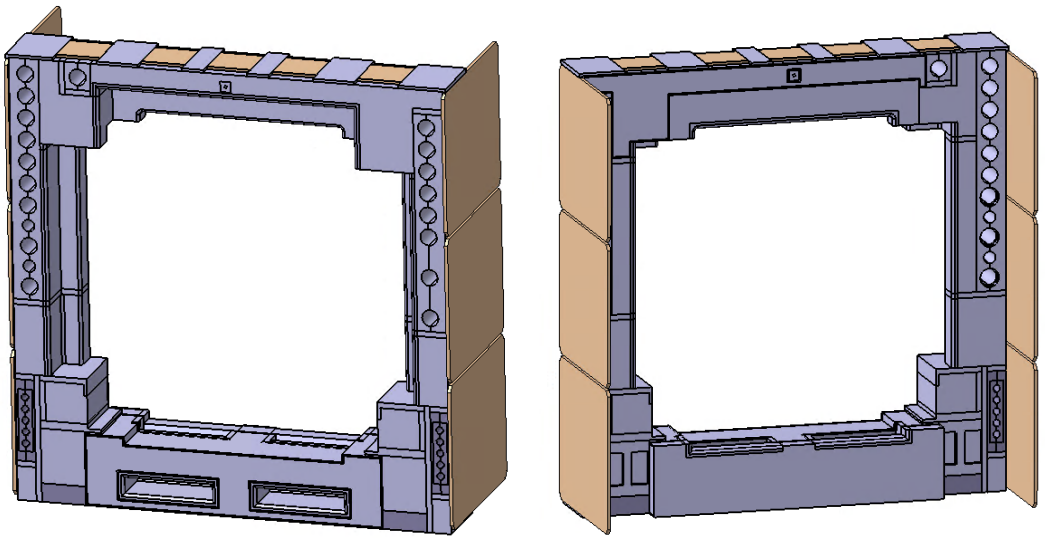

Figure 2-12 B1 Remote Handling Ports BPs Captive Parts (in yellow) general views

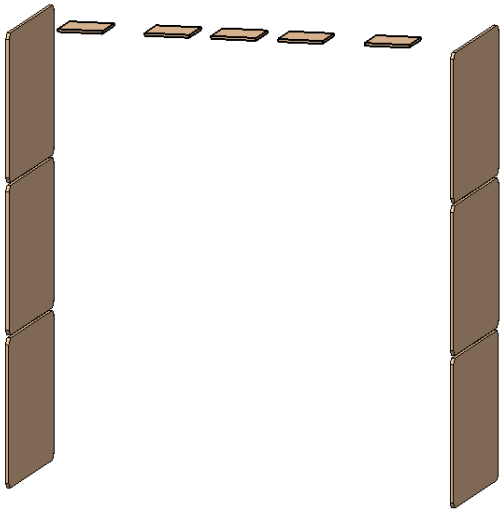

Figure 2-13 Intermediate plates

Captive parts indicative mass total 3.1 tons (around 15% on BP total mass of 20.4 ton):

- **Intermediate plates (SS304)::** 3.1 tons

- **B1 In-Vessel Viewing (IVV) Ports (C03, C05, C09,C11, C15, C17)**

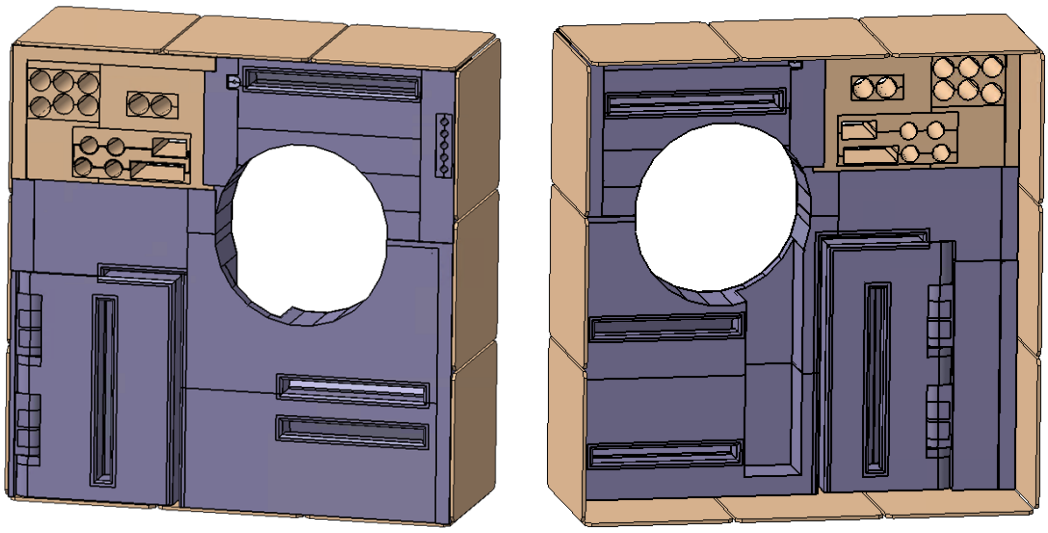

Figure 2-14 B1 IVVPorts BPs Captive Parts (in yellow) general views

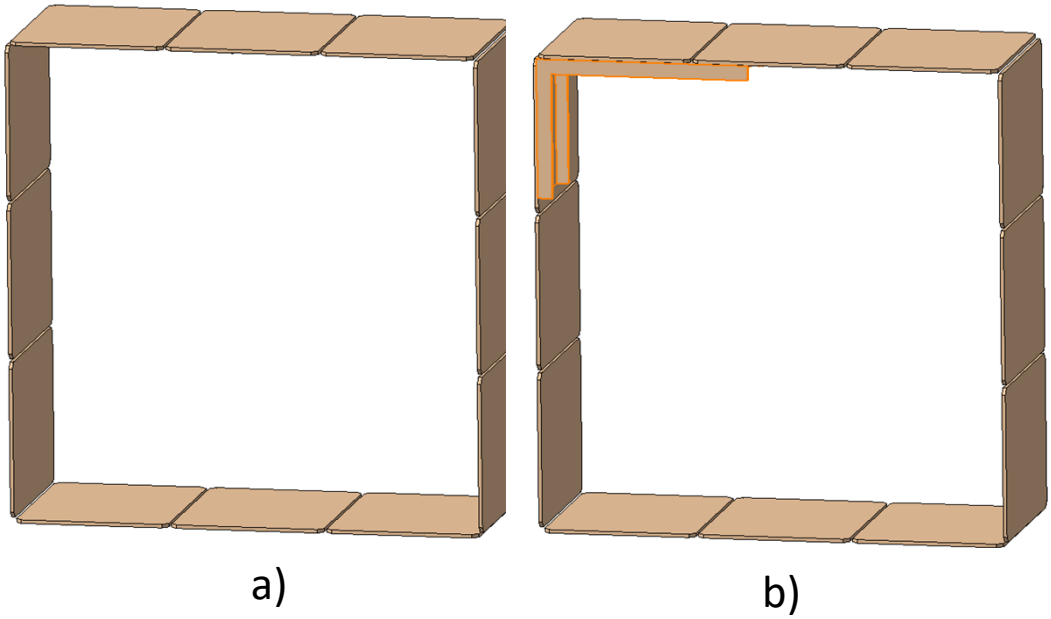

Figure 2-15 a)Intermediate plates b)Support plate

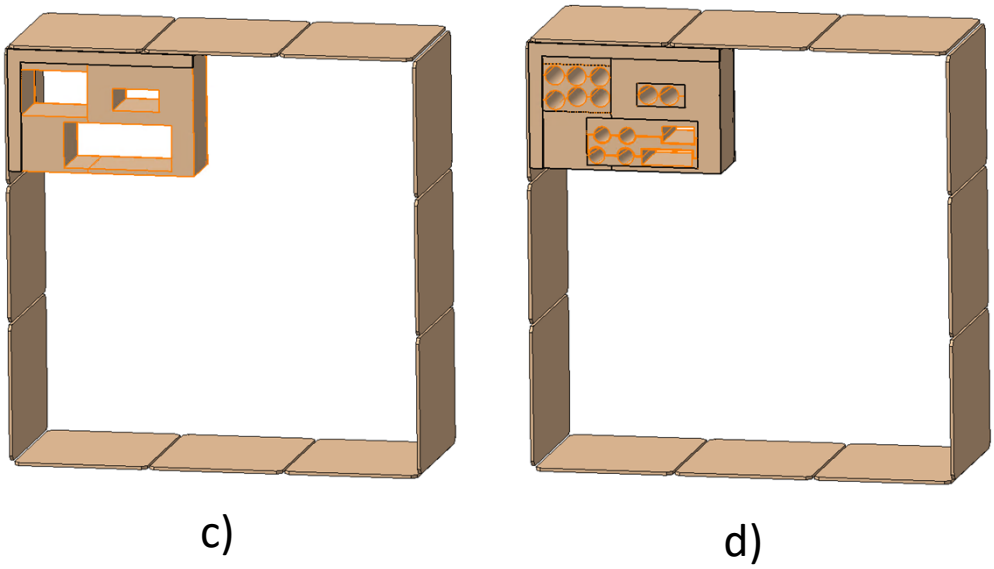

Figure 2-16 c)Shielding blocks d)Pipes sleeves

Captive parts indicative mass total 11 tons (around 31% on BP total mass of 35.3 ton):

- **Intermediate plates (SS304):** 5.8 tons
- **Support (SS304):** 0.5 tons
- **Shielding blocks (SS304+BHC):** 3 tons
- **Sleeves (SS304):** 1.5 tons

- **B1 Cryopump Ports (C04, C06, C10,C12, C16, C18)**

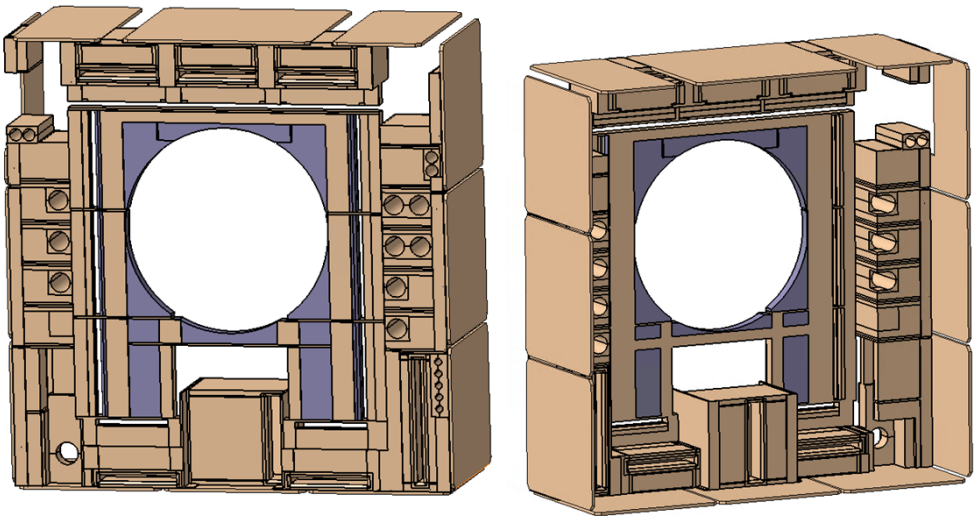

Figure 2-17 B1 Cryopump Ports BPs Captive Parts (in yellow) general views

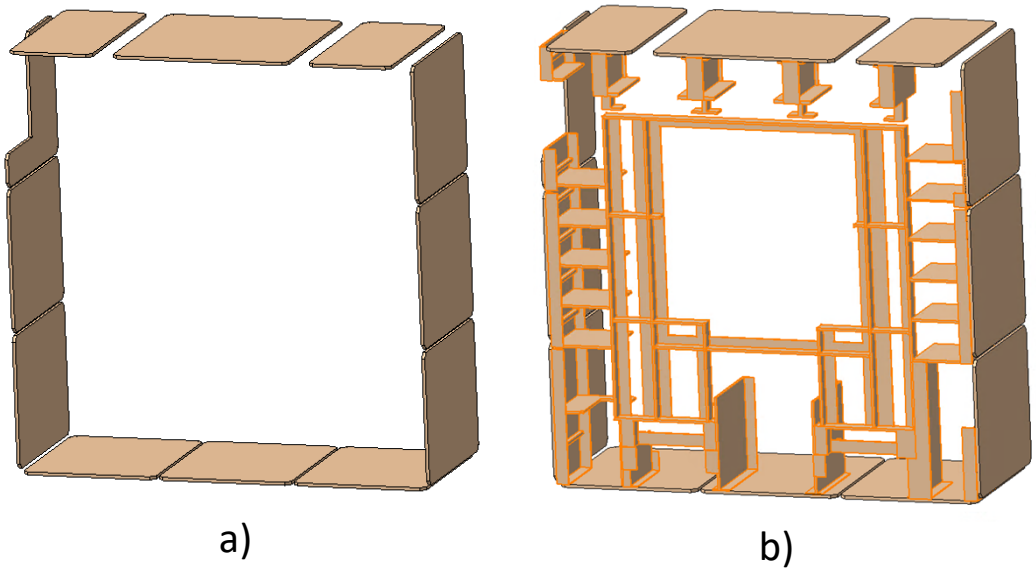

Figure 2-18 a)Intermediate plates b)Support frame

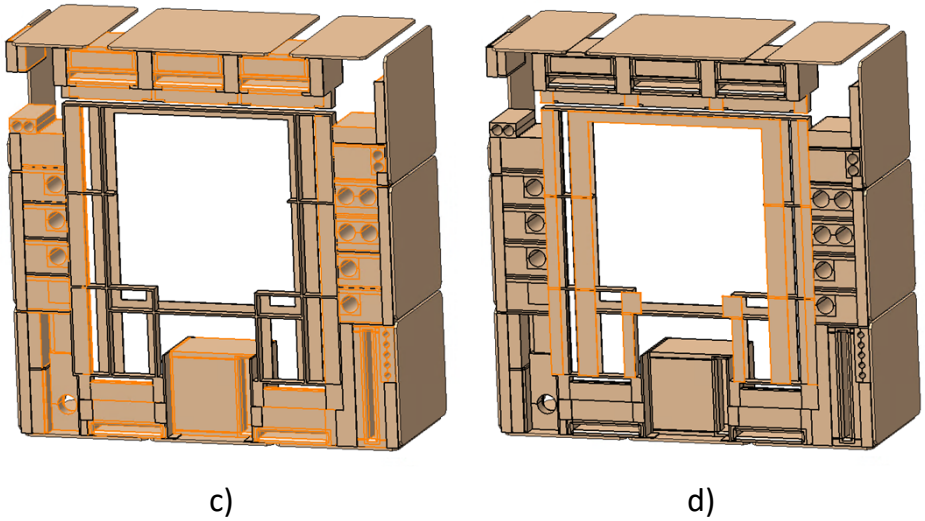

Figure 2-19 a)Shielding blocks, sleeves and adjustment plates b)Closure plates

Captive parts indicative mass total 20.9 tons (around 95% on BP total mass of 21.9 ton):

- **Intermediate plates (SS304):** 5 tons
- **Support frame (SS304):** 2.9 tons
- **Shielding blocks (SS304+BHC)), sleeves and adjustment plates (SS304):** 12.8 tons
- **closure plates (SS304):** 0.2 tons

2.1.4.2 Equatorial (L1) Ports Cells

- **L1 Equatorial (C01, C02, C03,C08, C09, C10, C11, C12, C14, C17)**

3D model of BP and captive parts are similar to those on of TBM case as in Figure 2-20 and Figure 2-21.

Captive parts indicative mass total 1.7 tons (around 7% on BP total mass of 22.7 ton):

- **Intermediate plates (SS304):** 1.7 tons

- **TBM Ports (C16, C18)**

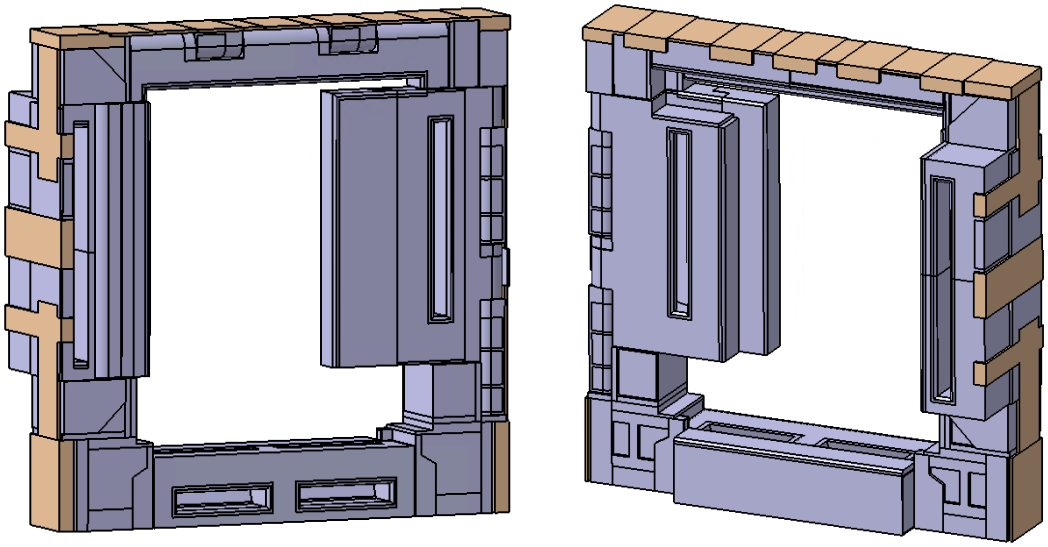

Figure 2-20 L1 TBM Ports BPs Captive Parts (in yellow) general views

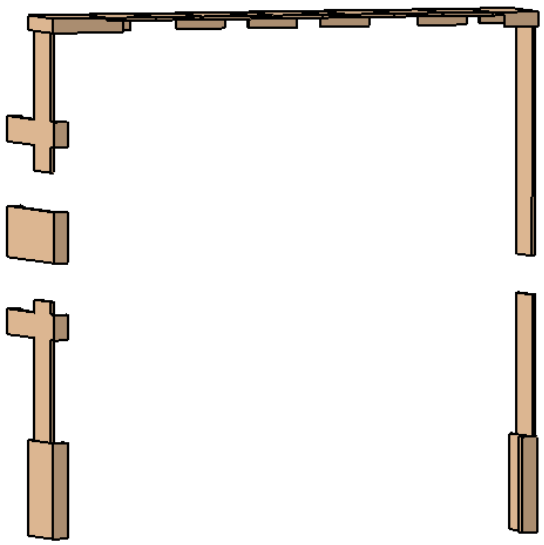

Figure 2-21 Intermediate plates

Captive parts indicative mass total 1.7 tons (around 7% on BP total mass of 22.7 ton):

- **Intermediate plates (SS304)::** 1.7 tons

- **ICH Ports (C13, C15)**

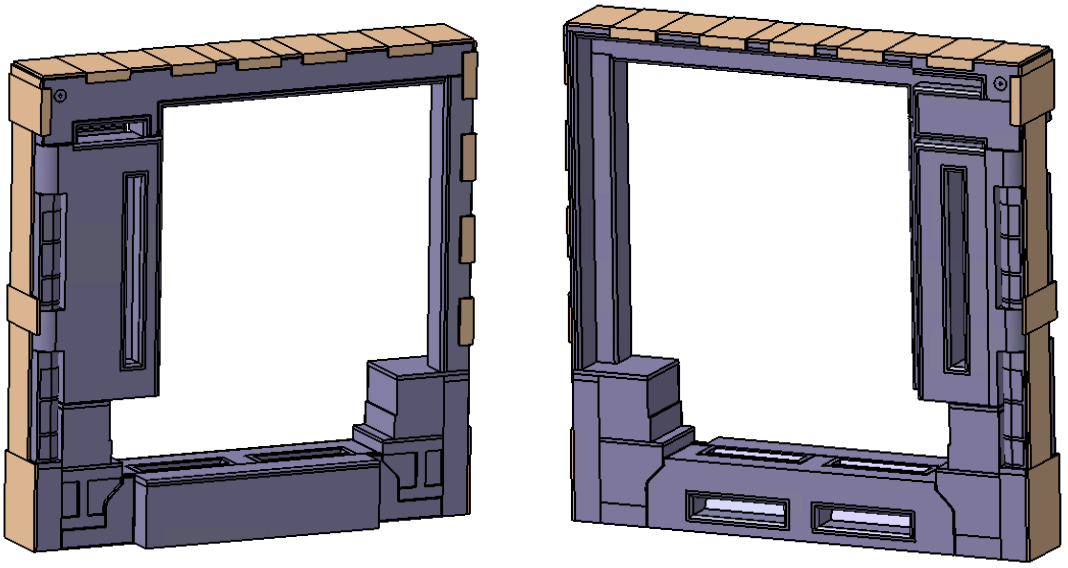

Figure 2-22 L1 ICH Ports BPs Captive Parts (in yellow) general views

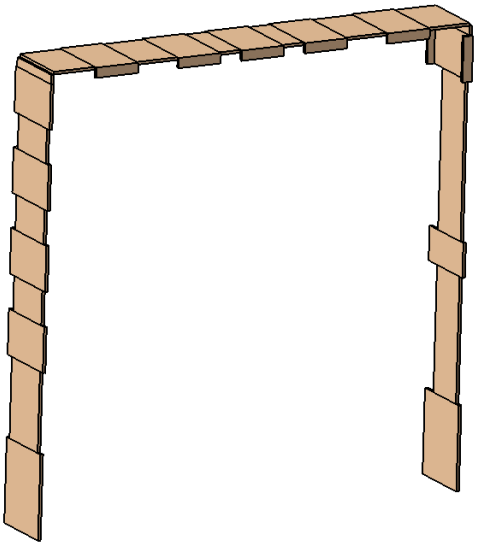

Figure 2-23 Intermediate plates

Captive parts indicative mass total 1.4 tons (around 7% on BP total mass of 19 ton):

- **Intermediate plates (SS304)::** 1.4 tons

2.1.4.3 Upper (L2) Ports Cells

- **Upper Port (C01, C02, C03,C08, C09, C10, C11, C14, C17, C18)**

3D model of BP and captive parts are similar to those on of ECH case as in Figure 2-24 and Figure 2-25.

Captive parts indicative mass total 3.6 tons (around 15% on BP total mass of 24.3 ton):

- **Intermediate plates (SS304)::** 1.5 tons
- **Busbar penetrations and supports (SS304)::** 2.1 tons

- **ECH Ports (C12, C13, C15, C16)**

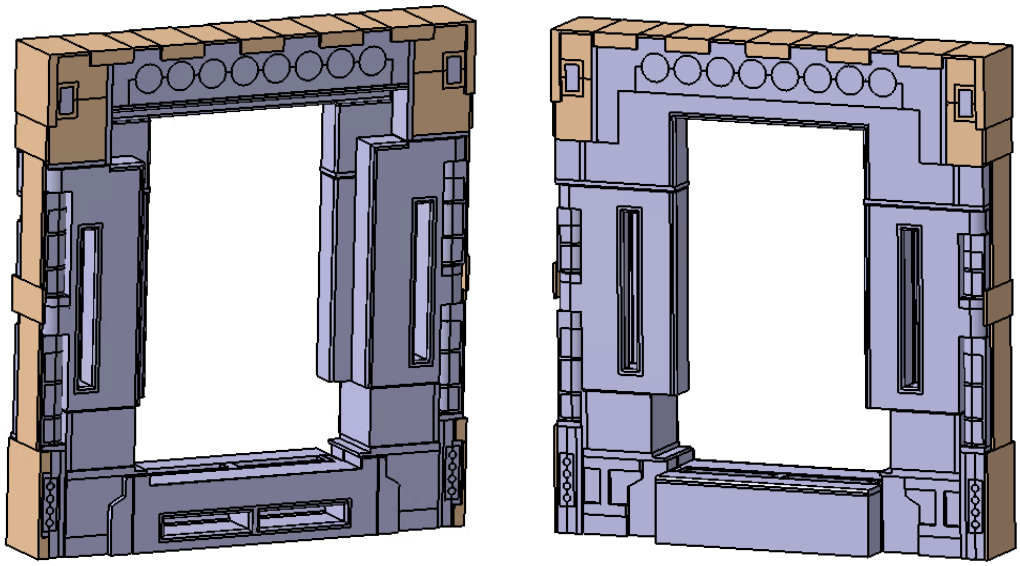

Figure 2-24 L2 ECH Ports BPs Captive Parts (in yellow) general views

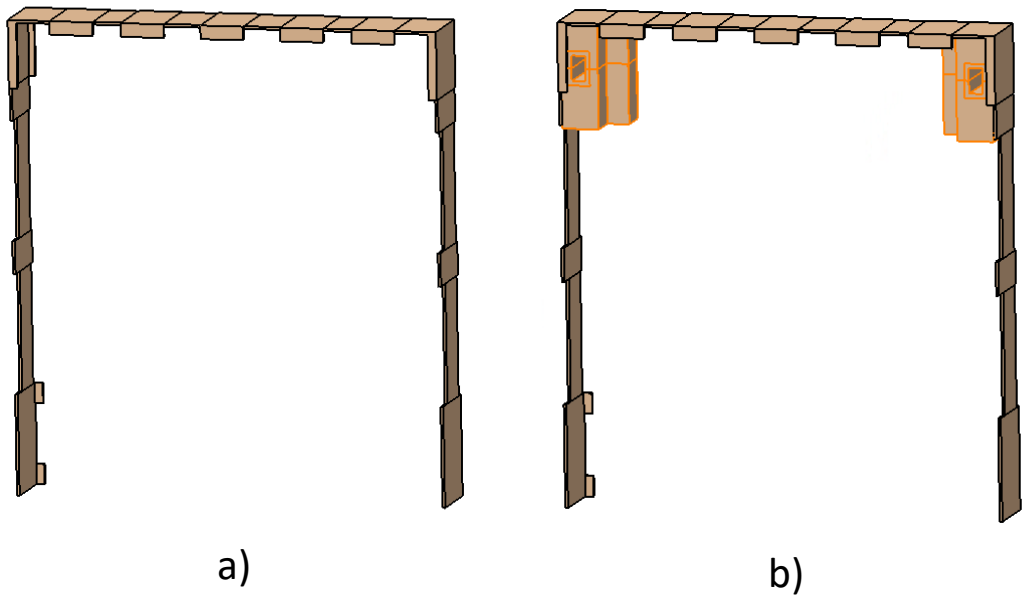

Figure 2-25 a)Intermediate plates b)Busbar penetrations and supports

Captive parts indicative mass total 3.6 tons (around 15% on BP total mass of 24.3 ton):

- **Intermediate plates (SS304)::** 1.5 tons
- **Busbar penetrations and supports (SS304+BHC)::** 2.1 tons

2.1.4.4 NB Cell (L2) Upper Ports (UP 04, UP 05, UP 06, UP 07)

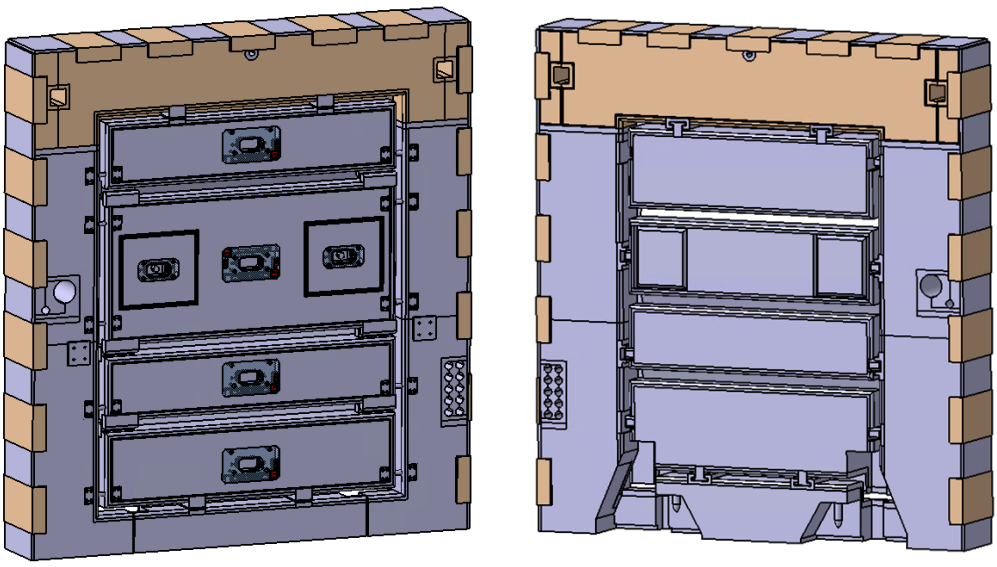

Figure 2-26 L2 ECH Ports BPs Captive Parts (in yellow) general views

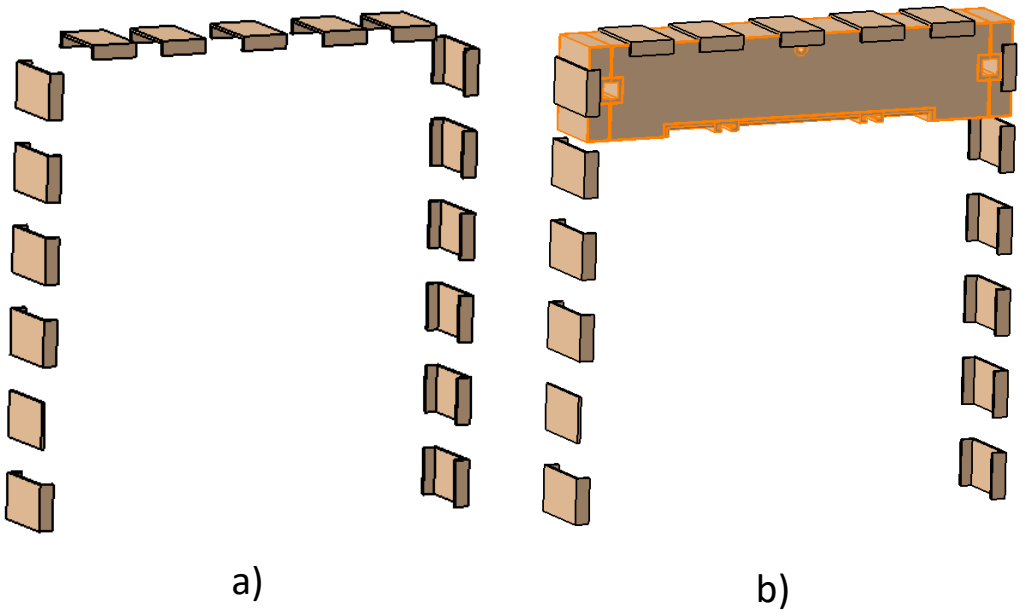

Figure 2-27 a)Intermediate plates b)Lintel, busbar penetrations and supports

Captive parts indicative mass total 8.6 tons (around 23% on BP total mass of 37.1 ton):

- **Intermediate plates (SS304)::** 1.1 tons
- **Lintel (SS304+BHC), busbar penetrations and supports (SS304)::** 7.5 tons

2.1.5 BPs Masses Summary

Table 7 BPs Masses summary

Level	Bioshield Plugs Type	Ports Number	Captive parts	Captive parts estimated mass (ton)	Bioshield Plug total mass (ton)
B1	**Cryostat Ports**	3	- Intermediate plates (SS304) - Support plates plus filler plates (SS304) - Lintel shielding blocks (SS304+BHC) - Pipe sleeves and adjustment plates(SS304)	21x3=63	42.5x3=127.5
	Remote Handling	3	- Intermediate plates(SS304)	3.1x3=9.3	20.4x3=61.2
	In-Vessel Viewing (IVV)	6	- Intermediate plates(SS304) - Support plates plus filler plates(SS304) - shielding blocks (SS304+BHC) - Pipe sleeves (SS304)	11x6=66	35.3x6=211.8
	Cryopump	6	- Intermediate plates (SS304) - Support frame (SS304) - shielding blocks (SS304+BHC), sleeves (SS304) and adjustment plates (SS304)	20.9x6=125.4	21.9x6=131.4
L1	**Equatorial**	10	- Intermediate plates (SS304)	1.7x10=17	22.7x10=227
	TBM	2	- Intermediate plates (SS304)	1.7x2=3.4	22.7x2=45.4
	ICH	2	- Intermediate plates (SS304)	1.4x2=2.8	19x2=38
L2	**Upper Ports**	10	- Intermediate plates (SS304) - Busbar penetration and supports (SS304)	3.6x10=36	24.3x10=243
	ECH	4	- Intermediate plates (SS304) - Busbar penetration and supports (SS304)	3.6x4=14.4	24.3x4=97.2
NB Cell (L2)	**Upper Port**	4	- Intermediate plates (SS304) - Lintel (SS304+BHC) Busbar penetration and supports (SS304)	8.6x4=34.4	37.1x4=148.4
			Totals	**372 ton (28% of total mass)**	**1331 ton**

3 Scope.

The development of an integrated design for the entire Bioshield Plug system as described in Section 2 is in the scope of work of this technical specification. This activity shall take into account:

- The concept design provided by IO as described in §2
- Input data package as in Table 2, Table 4 and Table 6
- List of requirements as in § 4

Specifically, the list of deliverables to provide and due dates are detailed in §8.

The participation to a Final Design Review (FDR) meeting (1-2 days meeting) is mandatory to attend and shall be considered as a formal gate for final acceptance by IO of the system design.

4 Design Requirements.

Exhaustive list of design requirements for bioshield components as well as compliance with concept design are inside the Design Compliance matrixes (DCMs) provided in [2], [9] and [15].

Main design requirements have been extrapolated here below:

[Req.1] System Classification

Bioshield Part system and components are Safety Class SIC-2, Seismic Class SC1(S) and Quality Class QC1. This implies the structural stability in case of seismic event of level SL-2 and quality requirements for design, fabrication and installation according to [22] correspondent QC1.

[Req.2] BP components volumes and system interfaces

Dedicated volumes for BP components as well as positioning of main crossing elements and system interfaces are according to input 3D configuration models to be provided at Kick off Meeting (KoM).

[Req.3] As built data of building Embedded Plates (EPs)

Positioning of BP anchorage points to be consistent with as built data to be provided by IO at KoM.

[Req.4] Structural requirements

Compliance with structural requirements are assessed in considering loads and loads combination as in the structural verifications [5], [11] and [17].

[Req.5] Nuclear shielding

Compliance with nuclear shielding requirements are assessed in verifying consistency with geometries and materials assumed in shielding calculations [6], [12] and [18].

[Req.6] Air Flow passage

Compliance with air flow passage requirements are assessed in verifying consistency with openings geometries as in [7] and [19].

[Req.7] Materials

Required materials are non-flammable material and non-magnetic:

- Stainless steel boxes filled with Borated Heavy Concrete for shielding blocks (SS304+BHC);
- Stainless steel for intermediary plates, shielding blocks supports, adjustment plates and pipe sleeves (SS304);
- Neutron absorber material (i.e. borated silicon, boron carbide) around dog legs.

[Req.8] Item Part Number of ITER (PNI)

At final design, all Individually Distinguishable Items (IDIs) shall be identified and properly tagged with the PNI's (Part Number of ITER). Request the PNI's via IO-Eng-Responsible Officer, who will issue a CAD-Ticket to obtain the necessary PNI's (According to Ref. [23].)

5 Estimated Duration.

A total duration of 8 months is estimated for completing the activities in the scope of the present contract.

6 Acceptance Criteria.

Design acceptance and validation is done through approval of documentation inside ITER IDM. The participation to a Final Design Review (FDR) meeting (1-2 days meeting) is mandatory to attend and shall be considered as a formal gate for final acceptance by IO of the system design including the resolution of issues (so called chits during FDR). Such resolution phase may require reworking of relevant deliverables in following up the FDR meeting.

7 Work Monitoring and Meetings.

Work monitoring is done through progress meetings, review of deliverables on IDM and during the FDR meeting.

Working progress meetings are held at least be-weekly. More frequent meetings can be organized upon specific needs.

Meetings locations are normally by remotely. Face to face meeting maybe organized in case, at IO premises.

8 Deliverable list and due dates

Deliverable Id.	Deliverable	Content	Foreseen date
-	Kick Off Meeting	-	T0+2W
01	Quality plan	Refer to §12	T0+4W
02	3D CAD model(s)	via DET Process as specified in §10	T0+16W
03	2D drawings	2D Drawings at level of details ready for manufacturing	T0+17W
04	Bill Of Material (BOM)	List of parts and components mass in line with format and content level of BOMs provided within input data package	T0+17W

Deliverable Id.	Deliverable	Content	Foreseen date
05	Structural assessment	Technical report for assessing compliance of design with structural requirements. New updated analysis should be required for final design with reference to technical reports provided within input package	T0+18W
06	Shielding Assessment	Technical report for assessing compliance of design with shielding requirements. No new nuclear analysis are foreseen but mainly assessment of detail design with requirements affecting shielding behaviour with reference to shielding analysis provided within input data package.	T0+18W
07	Air Flow passage Assessment	Technical report for assessing compliance of design with Air Flow Passage requirements. No new CFD analysis are foreseen but mainly assessment of detail design with requirements affecting air flow passage behaviour with reference to CFD analysis provided within input data package.	T0+18W
08	System Design Description Document (DDD)	Design description report in line with format and content level of DDDs provided within input data package. Document need to be addressed to contract scope for describing detail design of captive parts. - Main design drivers - Technical solutions adopted - Fabrication sequence description, risks identification and mitigation. - Installation sequence description, risks identification and mitigation. - Schedule estimation for captive parts fabrication and installation - Cost estimation for fabrication and installation	T0+20W
09	Design Compliance Matrix (DCM)	List of requirements relevant for designing bioshield plug parts including design compliance in line with format and content level of DCMs provided within input data package. Document need to be specifically addressed to contract scope for identifying all requirements relevant for captive parts and design compliance with design documentation.	T0+20W

Deliverable Id.	Deliverable	Content	Foreseen date
10	Final Design Review Presentation	Slides for presenting the design at Final Design Review Meeting: - Main design drivers - Technical solutions adopted - Design Assessment/Calculations - Risks identification summary for fabrication and installation - Schedule estimation summary for captive parts fabrication and installation - Cost estimation summary for fabrication and installation	T0+24W
11	Final Design Review Design Improvement	Summary report for tracing the resolution of issues/design improvements following up the Final Design Review with the impacted deliverables.	T0+32W
12	Technical specification for fabrication and installation	Technical document specifying specifications for proceeding with fabrication and installation phase: - Relevant drawings for fabrication and installation of captive parts. - Relevant Design Documentation - Materials compositions and certification - Qualification required and procedures - Tests plan Special equipment if needed	T0+32W

9 Packaging and Handling.

NA

10 CAD models.

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

- The contractor is proposed to work in asynchronous collaboration scheme where contractor will work “File-based”. See detailed information about asynchronous collaboration scheme in the Specification for CAD data Production in ITER direct contracts (P7Q3J7) [24]
- The CAD data identified as input in this document will be transferred through the appropriate Data Exchange Task (DET) performed by the IO to the contractor at the kick-off date, as specified in the Procedure for ITER CAD Data Exchanges (2NCULZ) [25]
- For the execution of the CAD 3D models and drawings, the choice is given to the contractor for the production in CATIA V5 (R31) or other CAD software allowing the usage of 3D models in the ITER Digital Mock Up after a possible conversion through a CAD neutral format (such as step).

- If the CATIA software is selected by the contractor, they shall use the CATIA version indicated in the latest version of the ITER CAD Manual released by IO DO, CATIA V5 (R31 currently) CAD Manual 07 - CAD Fact Sheet (249WUL) and install the 02 ITER CAD supplier package (6XS6JU) [26]
- The contractor shall ensure that all CAD Data (Models and Drawings) delivered to IO comply with the "Procedure for the Usage of the ITER CAD Manual (2F6FTX)" [27], scope applicability full or partial shall be considered based on the selection of the CAD software CATIA or MultiCAD.
- The contractor shall submit the drawings and diagram in the SMDD for the IO approval according to the procedure Diagrams and Drawings Management System Working Instruction (KFMK2B) [28]
    - If contractor will perform the drawings in any other CAD tools other than CATIA. The drawings title blocks and other specification comply with the section 2.3 (Drawing features) of the AUTOCAD guidelines (U65T95) [29]
    - ISO drawing standards are given in the CAD Manual 10 - ISO Drawing Standards (24MZWV v3.0) [30]
- If any deviation against these requirements shall be defined in a Design Collaboration Implementation Form (DCIF) prepared and approved by DO.

11 Structural analysis.

Structural analysis and reports shall be written in full agreement with documents 22MAL7 [31], 35BVV3 [32] and VT29D6 [33]. Analyses will be based on geometry and material properties that is unambiguously traceable, whose references shall be reported in the report. All input loads used for the analysis shall be listed and described clearly and unambiguously in the report, and shall all come from the relevant approved ITER System Load Specification. The FE analyses shall be fully verified following the requirements in 35BVV3 [32]. Any software package used shall be validated. See 22MAL7 [31], 35BVV3 [32] and VT29D6 [33] for the full set of analysis requirements.

Reports shall be written following the template in VQVTQW [34].

All reviewer checklists as for 35BVV3 [32] shall be attached to the reports, using the templates in VQVFEN [35], RYATXV [36] and TK33SU [37]. The scope of reviewers shall be reported in any analysis report including the minimum scopes required by 35BVV3 [32].

All the analysis files including FEA models and spreadsheets shall be stored in the ITER analysis database following the instructions and requirements of [38], i.e. they shall include all files necessary to get the reported results (e.g. including macros & spreadsheets), be linked to the analysis report, with their metadata filled properly, shall be stored in a sensible and organized folder of IO's Analysis Model Database, shall be in a ready-to-run state (the technical checker shall rerun the analyses to verify this), shall be commented /organized to be clearly and unambiguously understandable by a third party. Proper storage formats shall be used, i.e. that privileges robustness and exhaustiveness

12 Quality Assurance (QA) requirements.

The organization 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 organization 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).

13 Nuclear Safety

As for safety classification of the system, the design finalization is considered a Protection Important Activities (PIA) according to INB Order [39] and the Contractor shall comply with the all requirements expressed in “Provisions for implementation of the generic safety requirements by the external actors/interveners” (SBSTBM). [40]

14 Occupational safety.

NA

15 Reference documents.

[1] ITER System Design Process (SDP) Working Instruction (4CK4MT v3.3).

[2] Bioshield Plugs at TKM L1-L2 Port Cells_DCM (4RA2ZS v1.1).

[3] Bioshield Plugs at TKM L1-L2 Port Cells_Design Description (DD) (4QQE5E v1.1).

[4] Bioshield Plug Functional Analysis (4QVD42 v1.0).

[5] Bioshield Plugs at TKC L1-L2 Port Cells - Door Structural Calculation for CDR (4T8Y84 v1.3).

[6] Scoping nuclear analysis for CDR design of peripheral BSPs for EP16 and UP16 (4T977V v2.0).

[7] Bioshield Plugs at TKM L1-L2 Port Cells - CFD Analysis and Heat Removal Assessment (4RF82G v1.0).

[8] Bioshield Plugs at TKC L1-L2 Port Cells_BOM (4QXCQ8 v1.0).

[9] Bioshield Plugs at TKM B1 Port Cells CDR2 DCM (5PWLMV v1.0).

[10] Bioshield Plugs at TKM B1 Port Cells CDR2 Design Description (DD) (5PH4EA v1.2).

[11] Bioshield Plugs at TKC B1 Port Cells CDR2 Structural Calculation (5Y5UK3 v1.1).

[12] Scoping nuclear analysis for CDR design of peripheral BSPs at B1 for LP02 LP11 and LP01 (5HM4WL v1.1).

[13] Bioshield Plugs at TKM B1 Port Cells CDR2 BOM (5PYYWH v1.1).

[14] Lower Cryopump PCs BP_Feasibility study for improving shielding of peripheral part and TCPH/TCP area (ITER_D_7G5J6S).

[15] DCM_CDR3 Bioshield Plugs remaining B1 & L1 Port Cells & NB Cell (6FDGZ6 v1.3).

[16] Design Description(DD)_Bioshield Plugs remaining B1 & L1 Port Cells & NB Cell (6EFBT6 V1.1).

[17] Structural Calculation_Bioshield Plugs remaining B1 & L1 Port Cells & NB Cell (6HYQZJ v1.0).

[18] Scoping nuclear analysis for CDR3 of Bioshield Plugs in B1 PC12 and L2 PC07 (6EFDAW v2.0).

[19] CFD Analysis - Scoping head loss assessment of the bioshield plug B11-B1-PC12 (6HZD83 v1.0).

[20] BOM_Bioshield Plugs remaining B1 & L1 Port Cells & NB Cell (6HZAT2 v1.1).

[21] List of Bioshield Plug assembly phase (WUJGCX v4.1).

[22] Quality Classification Determination (24VQES v5.2).

[23] Procedure for Identification and Control (U344WG v2.2)..

[24] Specification for CAD data Production in ITER direct contracts (P7Q3J7 v2.0).

[25] Procedure for ITER CAD Data Exchanges (2NCULZ v3.1).

[26] CAD Manual 07 - CAD Fact Sheet (249WUL v6.2).

[27] Procedure for the Usage of the ITER CAD Manual (2F6FTX v1.1).

[28] Diagrams and Drawings Management System Working Instruction (KFMK2B v2.2).

[29] AUTOCAD guidelines (U65T95 v1.1).

[30] CAD Manual 10 - ISO Drawing Standards (24MZWV v3.0).

[31] Procedure for Analyses and Calculations (22MAL7 v6.2).

[32] Instructions for Structural Analyses (35BVV3 v2.2).

[33] Instructions for Seismic Analyses (VT29D6).

[34] Template for Structural Analysis Reports (VQVTQW v1.0).

[35] Independent Peer Reviewer Checklist for Structural Analyses (VQVFEN v1.0).

[36] Reviewer Checklist for Structural Analyses (RYATXV v2.0).

[37] Technical Checker Checklist for Structural Analyses (TK33SU v2.0).

[38] Instructions for the Storage of Analysis Models (U34WF3 v1.2).

[39] Order dated 7 February 2012 relating to the general technical regulations applicable to INB - EN (7M2YKF v1.7).

[40] Provisions for Implementation of the Generic Safety Requirements by the External Actors/Interveners (SBSTBM v2.2).

[41] CAD Manual 07 - CAD Fact Sheet (249WUL v6.2).