IDM UID
DF8LDF

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10 Feb 2026 / 2.7 / Approved

EXTERNAL REFERENCE / VERSION

Load Specification

VS3-PS Load Specification for B13

Load specification for VS3 Power Supply components in B13

Approval Process			
	Name	*Action*	*Job Title / Affiliation*
Author	**Ahossy A.**	**10 Feb 2026:signed**	**Mechanical Engineer**
Co-Authors			
Reviewers	**Van kessel R.**	**25 Feb 2026:recommended (Short Cycle)**	**Electrical Engineer**
Previous Versions Reviews	**Doare G.** **Nafradi G.** **Pajak P.** **Perrin J.- L.** **Pince L.** **Roccella R.** **Ruiz P.** **Stewart P.** **Zhang X.**	**15 Jan 2026:recommended (Short Cycle) v2.5** **03 Dec 2025:recommended v2.4** **04 Dec 2025:recommended v2.4** **01 Dec 2025:recommended v2.4** **02 Dec 2025:recommended v2.4** **10 Dec 2025:recommended v2.4** **03 Dec 2025:recommended v2.4** **03 Dec 2025:recommended v2.4** **08 Dec 2025:recommended v2.4**	**IO/DG/ESD/NSE** **IO/DG/ESD/NSE** **IO/DG/SQD/QMD/QS** **IO/DG/ESD/DOME/DTAS** **IO/DG/ESD/EES** **IO/DG/ESD/DOME/DTAS** **IO/DG/ESD/DOME/DTAS** **IO/DG/ESD/CES** **IO/DG/ESD/DOME/DTAS**
Approver	**Li J.**	**04 Mar 2026:approved**	**Program Manager**
Information Protection Level: Non-Public - Unclassified *RO: Van Kessel Rick*			
Read Access	**LG: CPS internal , LG: EED Head and Section Leaders and CPS, AD: ITER, AD: IO_Director-General, AD: OBS - Configuration Management Section (CMS), AD: External Management Advisory Board, AD: OBS - Central Integration Division (CID), AD: IDM_Controller, AD: OBS - Configuration Management Section (CMS)...**		

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Change Log			
VS3-PS Load Specification for B13 (DF8LDF)			
Version	***Latest Status***	***Issue Date***	***Description of Change***
v0.0	In Work	07 Feb 2025	
v1.0	Signed	12 May 2025	PBS_41.Load_specification_for_VS3-PS_B13-iter First issue
v1.1	Signed	14 May 2025	Crowbar QC changed Typo corrected
v1.2	Approved	19 Jun 2025	Update following the answered comments in the previous version
v2.0	In Work	25 Nov 2025	This approved LS was updated to split the document into two separate IDM LS documents for the PBS41 VS3 Power Supply and the Extension Busbars 41.V3.BE which are now attached to the IVC Busbars with a different contract. This current IDM number is assigned to the VS3-PS. A new IDM number will be created for the LS for Extension Busbars 41.V3.BE. The changes in the document concern then the following two points: 1- The scope is now limited to only the VS3 Power Supply. The Extension Busbars connected to the IVC Busbars in B11L4 are excluded in §2, §5, §11 2- Update of the cooling temperature value from 43° to 33° and the consideration of the coolant pressure and temperature detailed according to ITER_D_DABD6D in §13.1.5 and in §13.3.2 Remark: Except these two points, the remaining part of the document remains intact
v2.1	Signed	26 Nov 2025	This approved LS was updated to split the document into two separate IDM LS documents for the PBS41 VS3 Power Supply and the Extension Busbars 41.V3.BE which are now attached to the IVC Busbars with a different contract. This current IDM number is assigned to the VS3-PS. A new IDM number will be created for the LS for Extension Busbars 41.V3.BE. The changes in the document concern then the following two points: 1- The scope is now limited to only the VS3 Power Supply. The Extension Busbars connected to the IVC Busbars in B11L4 are excluded in §2, §5, §11, §9 2- Update of the cooling temperature value from 43° to 33° and the consideration of the coolant pressure and temperature detailed according to ITER_D_DABD6D in §13.1.5 and in §13.3.2 Remark: Except these two points, the remaining part of the document remains intact
v2.2	Signed	28 Nov 2025	Typos
v2.3	In Work	01 Dec 2025	Copy/paste error in section 13.1.6
v2.4	Signed	01 Dec 2025	Typo corrected
v2.5	Signed	17 Dec 2025	Update following comments of the reviewers answered in IDM
v2.6	Signed	03 Feb 2026	Update following comments attached to the previous version
v2.7	Approved	10 Feb 2026	§13.3.3.3 removed following offline review

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1 Purpose

The purpose of this Load Specification is to define and prescribe the loads used for the Integrity Justification of the VS3-PS in B13. Specifically, this document provides the following:

- A report on the VS3-PS classification (Safety, Quality and Seismic).
- Description of all states of the VS3-PS during its life: assembly, start-up, operation, maintenance, shutdown.
- A report on the applicable codes and standards that will be used for the assessment of the design.
- The correlation between load categories and damage limits and the correlation between the damage limits and the structural design in the applicable codes.
- The description of all events expected in each state (including normal, incident and accident conditions if needed).
- The specification of all load values to be considered to verify the structural integrity of the system and their categorization.
- The list of all load combinations to be considered to verify the structural integrity of the system and their categorization.
- The number of occurrences of each event during the life of the system and the number of load cycles.

2 Scope

This document concerns all the following components of the PBS41 VS3-PS installed in B13:

- All systems, structures and components of the PBS41 VS3-PS
- The internal busbars and connection boxes in the scope of the VS3-PS.
- The internal cables and cable trays
- The internal cooling pipes.

The VS3 Extension Busbar (41.BE) and VS3 Linkboard and IVC Busbars (41.BB) are not in the scope of this load specification.

No PIC component is in the scope of this load specification.

This document is prepared in the framework of the VS3-PS CDR.

3 Scope of Reviewers

Reviewer	Scope
Van Kessel Rick	SSC RO • The general applicability of the information included in the load specification is correct. • The scope is correctly defined in terms of geometry. • The Load Specification covers the required damage limits for all the applicable loading categories, the related design criteria, and the functional requirements for all the parts of the SSC.
P. Stewart	Member of PBS 62 • The consistency of the Load Specification with the referenced interfaces with PBS 62, and the correctness of the related conclusion.
P. Pajak	QA reviewer • The designated QARO to ensure that the QA requirements are met, according to the quality class of the SSC.
Pedro Ruiz	IEA reviewer • The requirements described in ITER_D_33TTPJ – Instructions for ITER System Load Specifications are implemented in the Load Specification.
G. Nafradi	RSG reviewer • The definition of nuclear loads and related requirements.
J-L. Perrin	DIS reviewer. • List of interfaces and any additional aspects related to System Integration.
Zhang Xiaotan	• Review of seismic loads
R. Roccella	• Review of electromagnetic loads
G. Doare	SRO • Safety
L. Pince	SIRO of PBS41

Table 1 – Scope of the reviewers

4 References

4.1 Applicable documents

[REF] Document Titles	IDM Links	Version
[01] ITER System Design Process (SDP) Working Instruction	ITER_D_4CK4MT	4.1
[02] Iter abbreviation	ITER-D_2MU6W5	1.19
[03] Guideline for ITER System Load Specifications	ITER_D_33TTPJ	3.3
[04] Template for ITER System Load Specifications	ITER_D_2PW74P	1.5

[REF] Document Titles	IDM Links	Version
[05] Load Specifications (LS)	ITER_D_222QGL	6.3
[06] Load Specifications for Buildings with Safety Requirements	ITER_D_2ERTXQ	3.8
[07] Safety requirement Room book v2.11	ITER_D_KF63PB	2.16
[08] ITER Coordinate Systems	ITER_D_2A9PXZ	3.7
[09] ITER Structural Design Code for Buildings (I-SDCB) - Part1: Design Criteria	ITER_D_283B24	3.4
[10] ITER Structural Design Code for Buildings (I-SDCB) – Part2: Construction	ITER_D_2E2U9X	2.0
[11] Interface Sheet (IS) Coil Power Supply & Distribution (PBS 41) - Reinforced Concrete Buildings (PBS 62) - Tokamak Complex Heat Loads	ITER_D_24SX4G	4.0
[12] System Requirements Document SRD 62-11 62-14 62-19 62-74 TKM	ITER_D_2DQZ92	3.4
[13] System Requirements Document SRD 62-13 Lay-down and Assembly Hall	ITER_D_2F7RGN	3.7
[14] Report - update of in-bioshield radiation maps during plasma operations (mode-0)	ITER_D_5DXPY7	1.0
[15] Preliminary Safety Report (RPrS)	ITER_D_3ZR2NC	3.0
[16] Application of the FRS Simplified Methodology to Building 13 - PBS 63.13 Assembly Building - F4E_D_3KQYXK	ITER_D_RW33SG	1.1
[17] EU-DA Report – PA 6.2.P2.EU.02 - Methodology to be Used to Generate the Seismic Floor Response Spectra for Ancillary Buildings at ITER – F4E-D-229SKE	ITER_D_PN36V6	3.1

Table 2 Applicable documents

4.2 Reference documents

4.2.1 Systems design documents

[REF] Document Titles	IDM Links	Version
[18] SRD-41_Coil_Power_Supply_and_Distribution	ITER_D_28B6XQ	6.0
[19] CMAF CMM for PBS 41 VS3 in Assembly Building 13	ITER_D_DQ7W6W	3.0

Table 3 Systems Design Description

4.2.2 Input data.

[REF] Document Titles	IDM Links	Version
[20] PCR-001640 - Relocation of some In-Vessel Coils (IVC) Power Supply components (ELM PS and parts of VS3 PS) from B11-L4 to B13	ITER_D_DMQ7SS	-
[21] PCR – 442 Implementation of In-Vessel Coil Power Supply System into the baseline	ITER_D_ETGFBT	-
[22] Expected absolute displacement for the buildings 11, 13 and 15 - Transmission Lines Location	ITER_D_SK26CZ	1.0

[23] Magnetic Field Map Database Query Tool User Manual	ITER_D_53KMVD	1.4
[24] IS-26.CC.2A-41-001 Interface between PBS26.CC.2A and Coil Power Supply & Distribution (PBS 41)	ITER_D_DABD6D	1.7

Table 4: Reference documents

4.2.3 *Directives*

[REF] Document Titles	IDM Links	Version
[25] 27.6.2014 EN OFFICIAL JOURNAL OF THE EUROPEAN UNION L 189/164 - DIRECTIVE 2014/68/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL OF 15 MAY 2014	**Directive 2014/68/UE**	05/2014

Table 5: Directives

4.2.4 Codes and standards

[REF] Document Titles	Document Number	Version
[26] Metallic industrial piping – Part 3 V2: Design and calculation	EN 13480 – 3 V2	2017
[27] Seamless steel tubes for pressure purposes -Technical delivery conditions- Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties	NF EN 10216-2	2014
[28] Butt-welding pipe fittings — Part 2: Non alloy and ferritic alloy steels with specific inspection requirements	NF EN 10253-2	2009
[29] Stainless Steel Tubes Dimension Tolerance	ISO 1127	1996
[30] CODETI 2010 Construction Code	CODETI 2010	2010
[31] Eurocode 3	NF EN 1993	2005
[32] Eurocode - Basis of structural design	EN 1990	2003
[33] Steel flanges	ISO 7005-1	1992
[34] Specification for Structural Steel Buildings	AISI 360	2022
[35] Power Piping	ASME B31-1	2022
[36] Welded and Seamless Wrought Steel Pipe	ASME B36-10M	2018
[37] Pipe Flanges and Flanged Fittings	ASME B16.5	2003
[38] Factory-made wrought buttwelding fittings	ASME B16.9	2001
[39] ASCE 7-16 Minimum Design Loads and Associated Criteria	ASCE 7	2016
[40] 19. AISC Steel_construction_manual_15th_edition	ISBN 978-1-56424-007-1	2017
[41] MSS SP-58	MSS SP-58-2009	2009
[42] Design and construction rules for mechanical components of nuclear installations high temperature, research and fusion reactors	RCC-MRx	2022

Table 6: Codes and standards

5 System Classifications

The system classification of the components of PBS41 VS3-PS components concerned by this load specification is given in SRD document in reference [18].

The components concerned by this classification are summarized in Table 7 below.

<table>
<tr><th>Component</th><th>Safety Class</th><th>Quality Class</th><th>Seismic Class</th><th>PED</th><th>NPE</th></tr>
<tr><td>• All VS3-PS SSCs, including:
• Internal Busbars
• Cables and cable trays
• Cooling pipe network</td><td rowspan="2">NSR (NON-PIC)</td><td>QC3</td><td rowspan="2">SC-2</td><td rowspan="2">Category (zero) Article 4.3 of [25]. Guideline ITER_D_VHC4YM applies.</td><td rowspan="2">Not applicable</td></tr>
<tr><td>• VS3-PS Crowbar</td><td>QC2</td></tr>
</table>

Table 7 System components classification

6 Codes and Standards

This load specification document is intended to be used by the future external Contractor who will complete the design of the PBS41 VS3-PS system. The Contractor will select the design codes for the technical analyses. Nevertheless, to allow an easy follow up by ITER, the following calculation codes are suggested, for information, in this load specification. One set of European codes and another set of ASME codes. The Contractor may select one of these codes for components for which both codes are possible.

The development of the calculation methodology will be performed by the Contractor based on the calculation code selected.

6.1 Material of PBS41VS3-PS system.

6.1.1 Type of material

The material specified below are the material of VS3-PS components made of structural steel material.

N°	Component	Type of profile	material		Identification norm	Dimension/tolerance norm	Remark
			Type	Norm			
1	Steel profiles for: - Pipe supports - Clable trays supports - Busbar supports - Platforms and false floors	Hollow square beams	S355J2	EN 10027-1	EN 10210-1	EN 10210-1/2	
2		HE beam			EN 10365	NF EN 10034	
3		IPE beam					
4		IPN beam					
5		UPE beam			EN 10279	EN 10279	
6		UPN beam			EN 10365		
7		Steel angle			NF EN 10056-1	NF EN 10056-2	
8		Steel tee			EN 10025-1/2	NF EN 10055	
9		Plate			EN 10025-1/2	EN 10058	

Table 8: Carbon steel products for PBS41 VS3-PS components

N°	Component	Type of profile	material		Identification norm	Norm for dimension /tolerance	Remark
			Type	Norm			
1	Steel profiles for: - Pipe supports - Clable trays supports - Busbar supports - Platforms and false floors	HE beam	Stainless steel bars according to EN 10088-1	EN 10027-2	EN10088-3	NF EN 10034	
2		IPE beam					
3		IPN beam					
4		UPE beam				EN 10279	
5		UPN beam					
6		Steel angle				NF EN 10056-2	
7		Steel tee				NF EN 10055	
8		Plate			EN 10088-4	EN 10029 E 10051	
9	Cooling pipes	Pipe	316L		EN10216-5	EN10216-5	

Table 9: Stainless steel products for PBS41 VS3-PS components

6.2 Synthesis of calculation codes for VS3-PS structural components

The building B13 is a conventional building in the Iter facilities.
Based on the classification given in §5, the mechanical and structural components of PBS41 VS3-PS can be designed using the following non-nuclear (conventional) calculation codes:

N°	Component	Function of the code	Calculation code	Application
1	All mechanical and Structural components	Design and procurement of mechanical and Structural components	EUROCODEs including the French National Annexes or ANSI/AISC 360	All steel structures which support mechanical or electrical components
3			EUROCODEs including the French National Annexe s	All steel structures that must ensure the safety of persons (e.g. main VS3-PS structure in B13, false floors, overhead structures, stairs cages, bridges, steel structures for corridor or pathways, etc.)
4	Pipes	Design of pipes	EN13480-3	All steel pipes
5			ASME B31-1	All steel pipes
6		Pipe dimension	EN 10216-5	Stainless steel pipes
7			ASME B36.19	Stainless steel pipes
8		Design of fittings	EN10253-4	Stainless steel fittings
9			ASME B16.5	Flanged fittings
10			ASME B16.9	But welded fittings

Table 10: Calculation codes

Note:

- The codes and norms listed in the table above may refer to other standards for the design and procurement of components. The Contractor is responsible to select and consider all the relevant standards referred to by the codes and norms in the table.
- For design according to EUROCODEs the Contractor shall consider the documents in reference [09] and [10] as well.

7 Definitions

7.1 Units

All loads are provided using the International System (SI) base and derived units. The only exception to this rule is that degrees Celsius may be used instead of Kelvin. The complete list of units used in this document is provided in Table 11.

Quantity	**Unit name**	**Unit symbol**	**In SI base units**
Length	Meter	m	
Mass	Kilogram	kg	
Time	Second	s	
Temperature	Kelvin	K	
	Celsius	°C	
Acceleration			m/s^2
Angular acceleration			rad/s^2
Angular velocity			rad/s
Density			kg/m^3
Energy, Work	Joule	J	N·m
Entropy			N·m/K
Force	Newton	N	$kg \cdot m/s^2$
Frequency	Hertz	Hz	1/s
Moment			N·m
Second moment of area			m^4
Power	Watt	W	N·m/s
Pressure	Pascal	Pa	N/m^2
Stress	Pascal	Pa	N/m^2
Young´s Modulus	Pascal	Pa	N/m^2
Thermal flux density			W/m^2
Velocity			m/s

Table 11: List of Units used in this Load Specification

7.2 Coordinate systems.

Unless stated otherwise all loads are specified in the ITER TGCS coordinate system in reference [08]. The main direction and the nomenclature used in this load specification are shown in Figure 1.

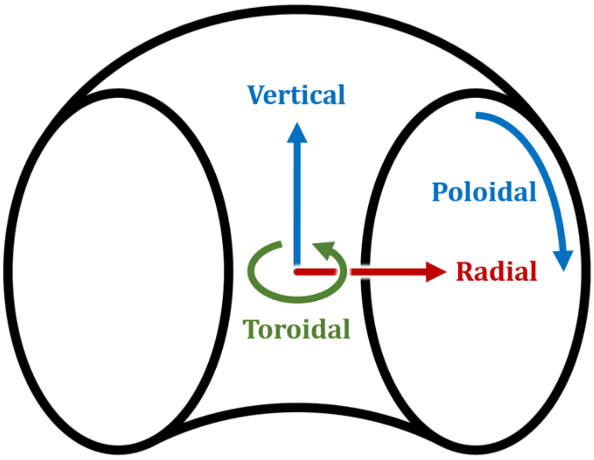

Figure 1 Definitions of tokamak directions and global cylindrical coordinate system

Table 12 lists all the local coordinate systems used in this document to specify applicable loads.

The local coordinate systems are specified in the dedicated calculation report for each analyzed Structural Steel Component "i" SSCi as follows.

ID	CX (m)	CY (m)	CZ (m)	RX (deg)	RY (deg)	RZ (deg)	Remark
CSi	CXi (m)	CYi (m)	CZi (m)	RXi (deg)	RYi (deg)	RZi (deg)	SSCsi

Table 12: Local coordinate systems used in this load specification.

7.3 Abbreviations

All abbreviations used in the document are listed in Table 13.

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

a_T	Acceleration Transp.
|B|	module
Bx	Component in x-direction
By	Component in y-direction
Bz	Component in z-direction
CS	Central Solenoid
DP_s	Seismic displacement
DP_t	Thermal displacement
DW	Dead Weight
DW_{test}	Deadweight during test
VS3-PS	Edge-Localized Mode Power Supply
EM	Electromagnetic load
IACC	Internal accident
ICE	Ingress of Coolant Event
IEMR	Internal emergency
IINC	Internal incident
LOCA	Loss of Coolant Accident
LOFA	Loss of Forced Flow Accident
PA	Procurement Arrangement
P_D	Design Pressure
PF	Poloidal Field
PLD	Pressure Limiting Device
PRD	Pressure Relief Device
P_{test}	Test Pressure
r	Radis from TKM center
SL1	Seismic Level 1
SL2	Seismic Level 2
SL3	Seismic Level 3
SMHV	Séismes Maximaux Historiquement Vraisemblables
SSCs	System, Structure or Component
TBC	To Be Confirmed
TBD	To be defined
T_D	Design Temperature
TF	Toroidal Field
UPC	Upper Pipe Chasse
VDE	Vertical Displacement Event
VS	Vertical Stability
T_m	Temperature during maintenance
T_t	Temperature during transport

Table 13: Abbreviations.

8 Types of Loads

According to the Guideline for ITER System Load Specifications in reference [03] §5.2.2 the type of loads is not required to be described at CDR phase.

The Contractor will complete and specify all the type of loads in later stage.

Nevertheless, the type of loads identified at current design phase are listed here after.

- Inertial loads
- Electromagnetic loads
- Pressure loads.
- Thermal loads.
- Assembly or installation loads.
- Manufacturing loads
- Specific loads e.g. corrosion

9 Main Loads

The main loads prescribed in this load specification are listed in the table below.

<table>
<tr><th colspan="2">Main loads</th><th>Chapter</th><th>Characteristic loads</th></tr>
<tr><td colspan="2">Dead Weight</td><td>11.2.1</td><td>Estimation of total mass of all PBS41 VS3-PS components in B13 during CDR: 345 tons</td></tr>
<tr><td colspan="2">Coolant pressure</td><td>13.1.5</td><td>Maximum pressure for pipe design: 15Bars</td></tr>
<tr><td colspan="2">Temperature</td><td>13.3.2</td><td>Maximal temperature in the pipe: 60°C</td></tr>
<tr><td rowspan="2">Electromagnetic loads</td><td>EM loads due to plasma transient events</td><td>13.1.7.1</td><td><table><tr><th>r</th><th>Bx [mT]</th><th>By [mT]</th><th>Bz [mT]</th><th>|B| [mT]</th></tr><tr><td>54.2</td><td>0.1</td><td>0.5</td><td>4.5</td><td>4.6</td></tr></table></td></tr>
<tr><td>EM loads due to operation of VS3-PS</td><td>13.1.7.2</td><td>TBD</td></tr>
<tr><td rowspan="2">Incidents and accidents</td><td>Internal PBS41 VS3-PS Incidents and Accidents loads</td><td>13.2.2</td><td>TBD</td></tr>
<tr><td>External PBS41 VS3-PS Incidents and Accidents loads</td><td>13.2.1</td><td>No significant impact on the VS3-PS</td></tr>
<tr><td>Relative displacements</td><td>Relative displacement between structures and buildings</td><td>13.6.1</td><td>TBD</td></tr>
<tr><td colspan="2">Seismic loads</td><td>13.1.6</td><td>Maximum peak accelerations 12.2 m/s²</td></tr>
<tr><td colspan="2">Acceleration during transport</td><td>13.1.3</td><td>Deceleration $a_T = 14.72\ \text{m}/S^2$ is assumed for the Emergency brake event.</td></tr>
</table>

Table 14: Main loads acting on the system/components.

Note: Calculation of the main EM load according to document in reference [23] is performed considering the point highlighted below

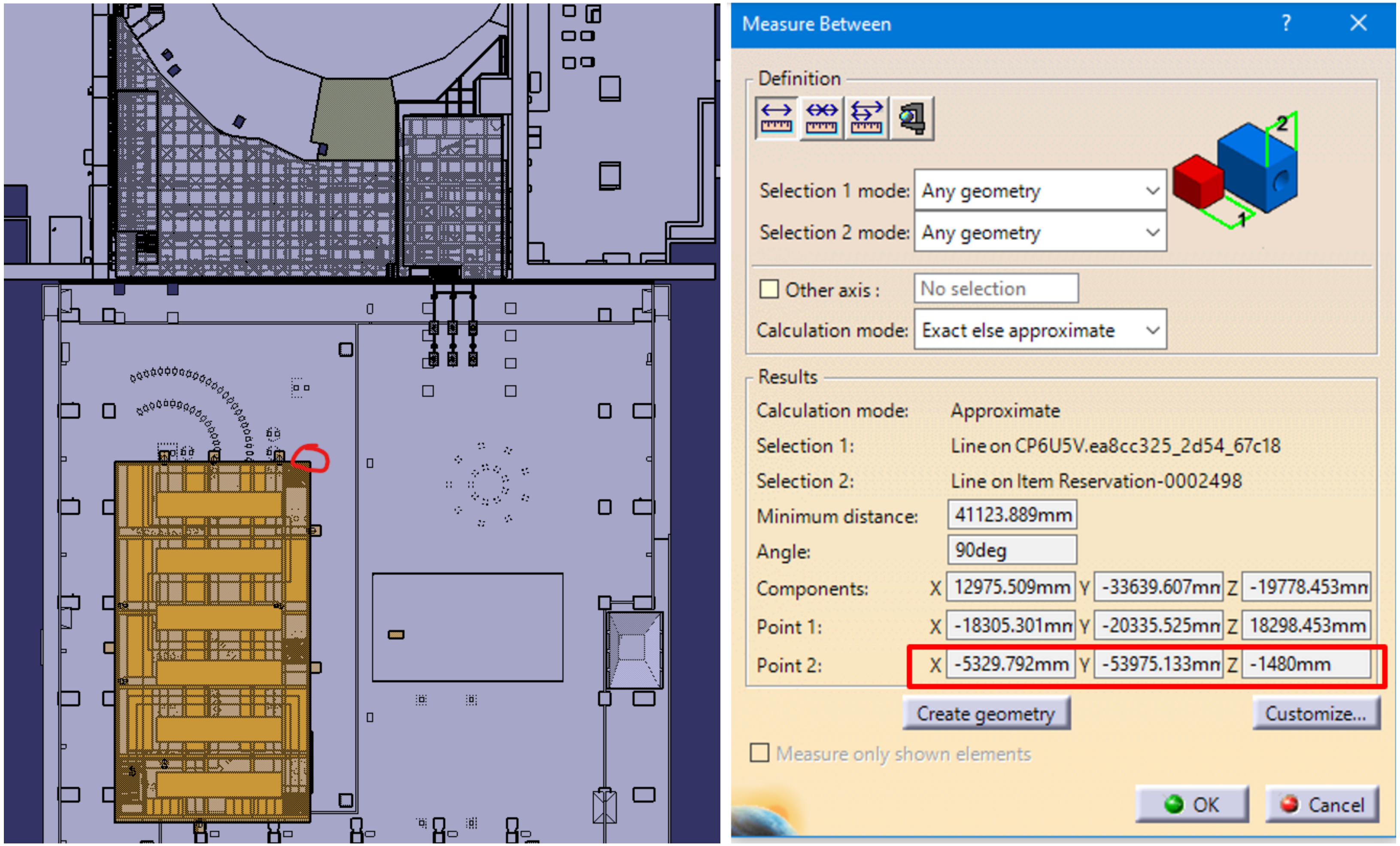

Figure 2 Considered points for the maximum EM loads.

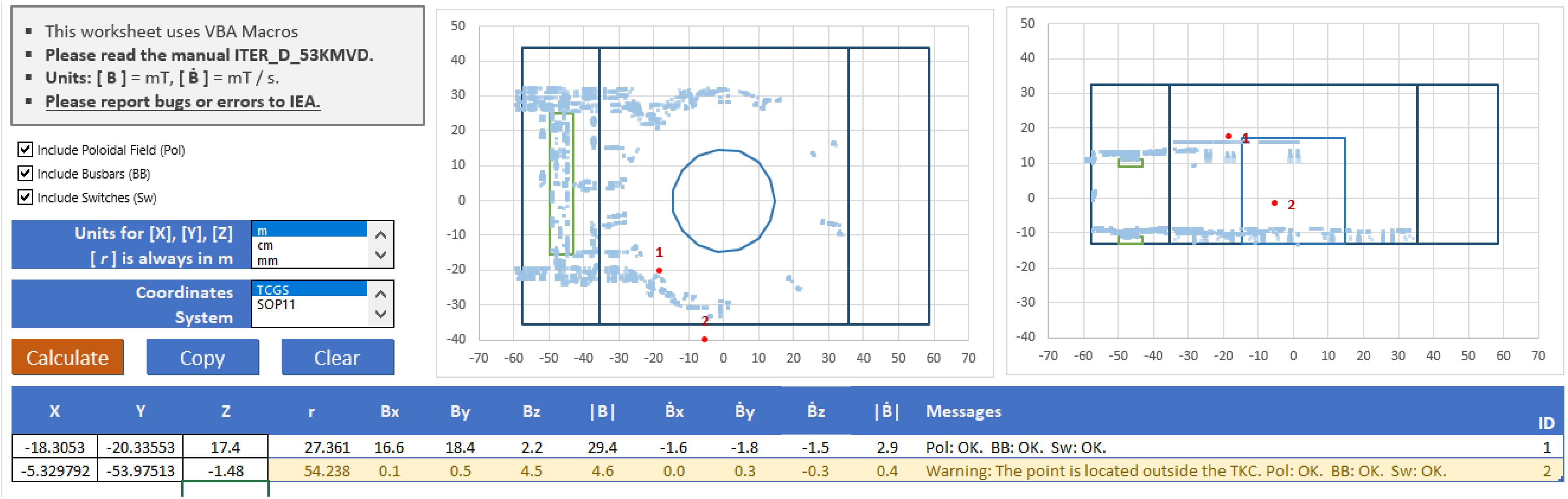

Figure 3 Main EM loads

10 Path of the Main Loads

The figure below shows where each load is applied and through which parts of the component it is transferred to the supports or to other interfaces.

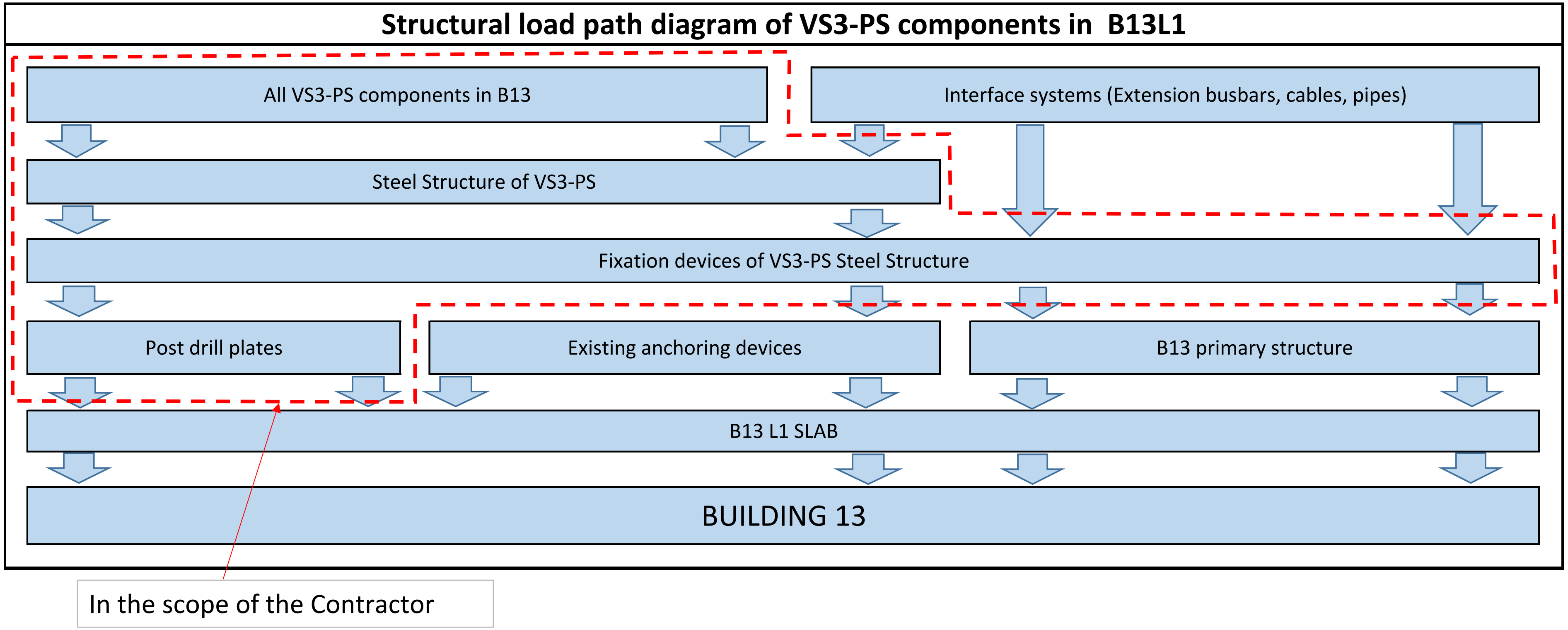

Figure 4: Load path diagram of VS3-PS in B13

Note: At this stage, this figure is presented as illustration purposes only. The Contractor shall update it according to the design of the VS3-PS system.

11 System Description

11.1 Design Status and Geometry

The current design phase of the SSCs in the scope of this load specification is CDR

The Contractor will provide the final design and geometry of the system. Nevertheless, the ongoing working (study) models of the system are available.

The concept design of VS3-PS system is provided in the document in the CMAF in reference [19] which provides the 3D data as well. The Extension Busbars in PBS41.V3.BE scope are excluded.

11.2 System Design Description

The design of the PBS 41 VS3-PS systems is provided in the System Requirement Document (SRD) in reference [18].

11.2.1 System, Components, Parts

The future Contractor will specify the list of parts and components. Nevertheless, the footprint of the area in B13 where VS3-PS system will be installed is given below.

Footprint of the area covered by VS3-PS components: ≈770m2

Total nominal approximate mass estimated for all VS3-PS components in B13: ≈345 tons.

The VS3-PS will be installed in the B13 called Assembly Hall at 600mm from the axis 13.2 and 4800mm from the axis 13.J of the B13 building

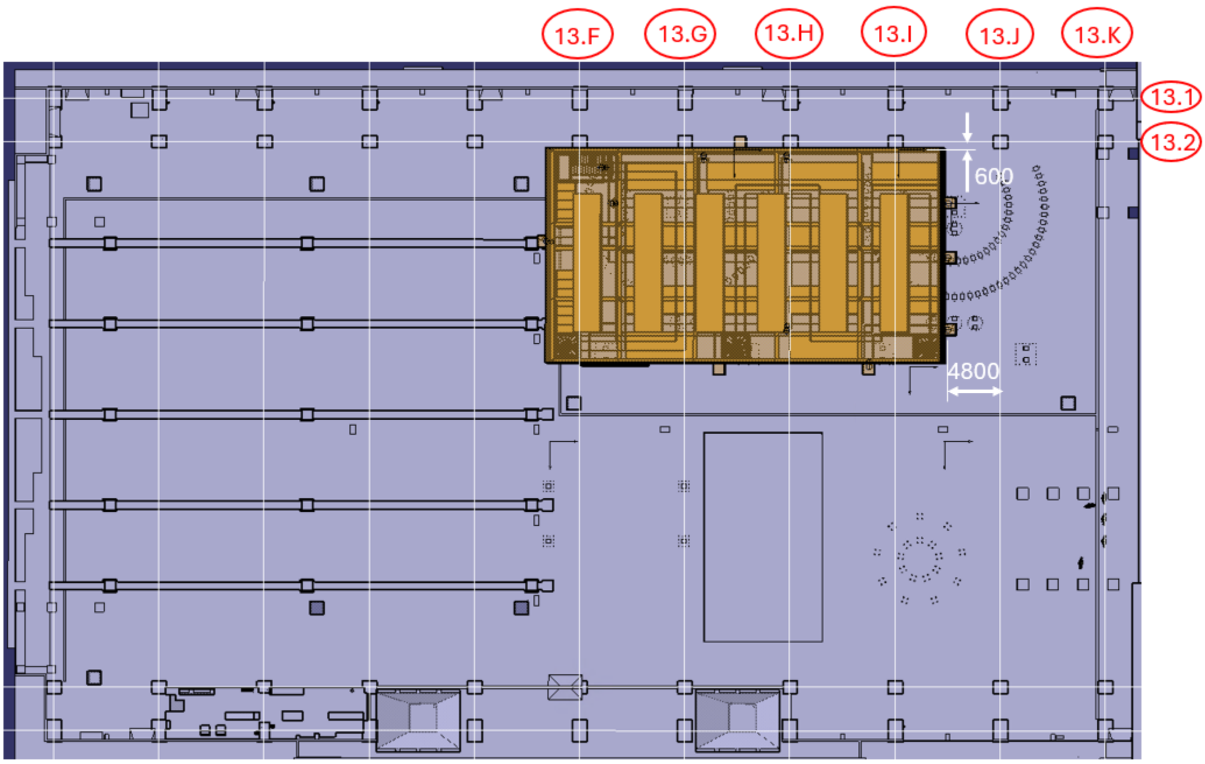

Figure 5: Location and footprint of VS3-PS system in B13

11.2.2 Fabrication and Assembly

The description of the fabrication and assembly process of the SSCs of VS3-PS under the scope of the load specification is not defined yet at the current CDR design phase.

It is foreseen that the VS3-PS will be supplied through external contracts.

Assembly and fabrication details will be specified during the coming design phases.

11.2.3 Functions

The function of VS3-PS system/components will be provided at later stage.

11.2.4 Interfaces

The relevant Interfaces Control Documents (ICD) and Interface Sheets (IS) are listed here after.

<table>
<tr><th rowspan="2">N°</th><th colspan="2">ICD</th><th colspan="2">IS</th></tr>
<tr><th>Reference</th><th>Title</th><th>Reference</th><th>Title</th></tr>
<tr><td>1</td><td>ITER_D_9MPWW6</td><td>Interface Control Document (ICD) between Coil Power Supply and Distribution (PBS41) and Assembly Building (PBS62.13)</td><td>ITER-D-9RCYJ5</td><td>IS-41-62.13-001 Interface sheet between PBS41.EL, PBS41.V3 and PBS62.13</td></tr>
<tr><td>2</td><td rowspan="2">ITER-D_35BQZA</td><td rowspan="2">ICD-41-43 Interface Control Document for Steady State Electrical Network (PBS 43) and Coil Power Supply and PPEN (PBS 41)3</td><td>ITER_D_M2WS9P</td><td>IS-43-41-501 Interface between LV Class IV Power Supply of SSEN and In-vessel coil power supply</td></tr>
<tr><td>3</td><td>ITER_D_E2ZJZF</td><td>IS-43-41-502 Interface between Class II-IP Power Supply of SSEN (PBS 43.BR) and In-vessel coil power supply (PBS 41.EL/V3)</td></tr>
<tr><td>4</td><td>ITER-D_2FPYX7</td><td>Interface Control Document (ICD) between Component Cooling Water System (PBS-26CC) and Coil Power Supply & Distribution System (PBS-41)</td><td>ITER_D_DABD6D</td><td>IS-26.CC.2A-41-001 Interface between PBS26.CC.2A and Coil Power Supply & Distribution (PBS 41)</td></tr>
</table>

Table 15: List of interface documents and ICD

12 States of System and Components

The table below provides the mapping between the Operating Modes of VS3-PS system and ITER Machine General Operating State (GOS).

N°	Iter Operation states	VS3-PS Operation states	State concerned
1	Plasma Operation State (POS)	Operation Mode	X
		Off Mode	
		Standby Mode	
		Non active Mode	X
2	Testing & Conditioning State (TCS)	Operation Mode	X
		Off Mode	X
		Standby Mode	X
		Non active Mode	X
3	Short Term Maintenance (STM)	Operation Mode	
		Off Mode	
		Standby Mode	X
		Non active Mode	X
4	Long Term Maintenance (LTM)	Operation Mode	
		Off Mode	X
		Standby Mode	
		Non active Mode	X

Table 16: Interface with building 11

The load occurring during each state is summarized in the table below.

N°	Category Load	Designation of Load	Operation Mode	Off Mode	Out of service	Non active
1	-	Test Pressure		X		
2	Category I	Pretention Load	X	X	X	X
3		Dead Weight	X	X	X	X
4		Design Pressure	X		X	
5		Design Temperature	X		X	
6		Magnetic Loads	X	X	X	X
7		Radiation Dose	X	X	X	X
8		Relative displacement due to thermal loads	X		X	
9		Tolerance	X	X	X	X
10	Category II	SL1 Seismic Load	X	X	X	X
11	Category III	SMHV Seismic Load	X	X	X	X
12		Relative displacement due to wind	X	X	X	X
13	Category IV	SL2 Seismic Load	X	X	X	X
14		Relative displacement due to seism	X	X	X	X
15		Acceleration Transport			X	
16		Fire Temperature	X		X	
17		Fire Pressure	X		X	

Table 17: List of loads and load categories

13 Single Load Cases

This chapter addresses all the single loads applied to the VS3-PS system. The load listed below are the load identified at current design phase.

During the execution of the contract, the Contractor will check and complete all the loads listed in this chapter. Any new load identified by the Contractor will be added to this list in the corresponding load category in§14.1.

13.1 Mechanical Loads

13.1.1 Dead Weight

The mass of the components of VS3-PS system will be provided by the future Contractor one the design will be specified. Then the dimension of the components and their center of mass will be specified.

13.1.1.1 Live loads

The service platforms and the false floors involving safety of people and covered by grating should be designed to withstand a live load of 500kg/m2.

13.1.2 Assembly and Pretension Loads

Information is not available at CDR phase. It is expected that these loads are not design driving loads. They will be confirmed in the next design phase.

13.1.3 Transport Loads

At this phase of design, the Transport System is not yet designed. An assumption is made based on the state of the art considering a deceleration value of $a_T = 14.72\ \text{m}/S^2$ is assumed for the Emergency Brake event. This value is based on feedback from experience for similar systems.

13.1.4 Test loads.

13.1.4.1 Test loads for VS3-PS.

Test loads for VS3-PS power supply will be specified in next design phase.

13.1.4.2 Test loads for coolant pipes for VS3-PS cooling systems.

For the piping network, the relevant test to perform is the pressure test.

According to §7.4 in PED in reference [25], the test pressure $P_{test} = 1.43.P_S$

Nevertheless, $P_{test} = 1.5.P_S$ is considered conservatively.

The test temperature is the ambient temperature 21° as stated in §13.3.3.1.

13.1.5 Coolant pressures

13.1.5.1 Concept connection of the cooling pipes of VS3-PS

The VS3-PS will be designed and provided by an external Contractor.

In order to explain and define the pressure to consider for the design, a concept of the connection to the existing IO piping system is provided as follows.

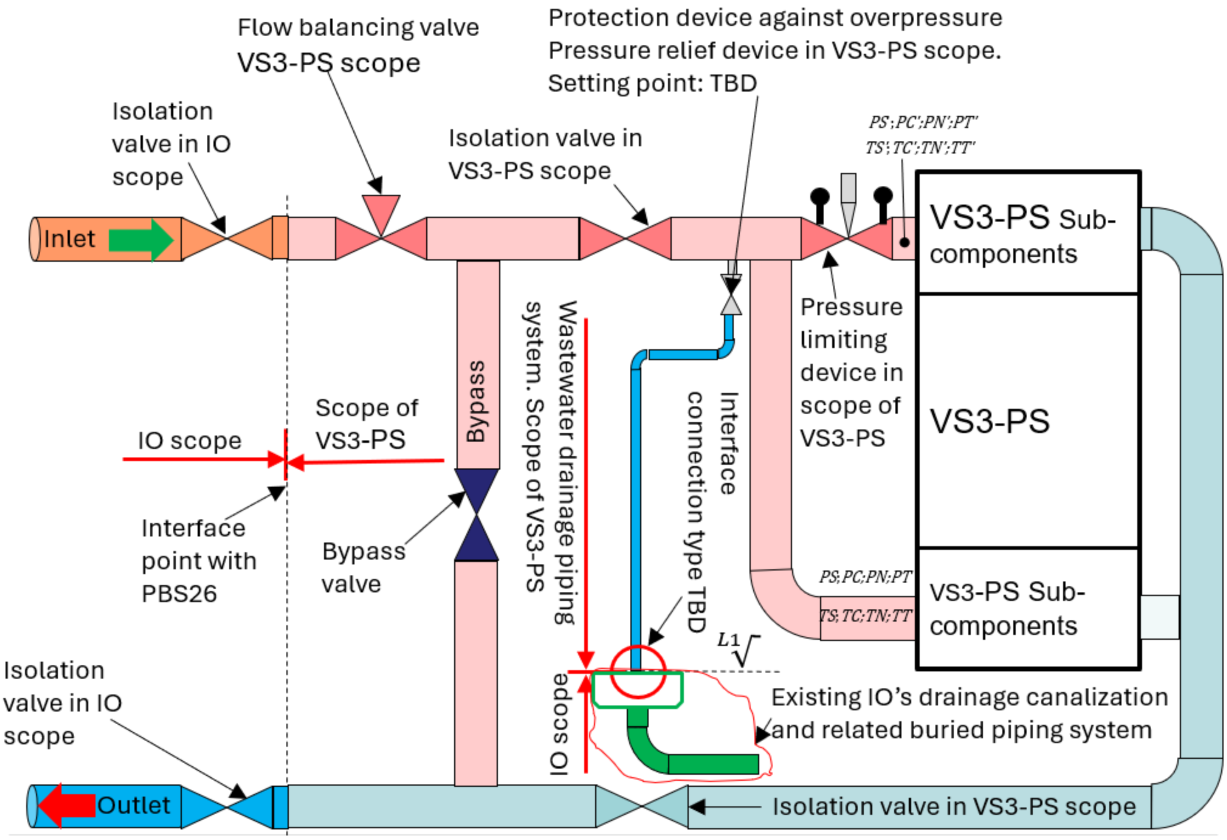

Figure 6. Concept illustration of the connection of the VS3-PS to the cooling and drainage system in B13

13.1.5.2 Pressure parameters in the pipe directly connected to the IO pipes at interface point

The parameters used for the coolant pressures are defined in the table below.

N°	Parameter	Definition
1	PS	Maximum Allowable Pressure in the IO pipe at the interface point. This value is the highest-pressure value expected in the IO pipe (PBS26) at the interface point considering all the incidents/accidents/startup/shunt down and transient changes: PED [25].
2	PC	Calculation or design pressure imposed by the IO for the design or calculation or all mechanical simulation of the resistance of all components directly connected to the IO pipe (PBS26) at the interface point without reducing the initial pressure: PED [25].
3	PN	Nominal steady state pressure in the IO pipes at the interface point after the stabilization of the system.
4	PT	Minimum test pressure used during the testing of the components or the systems or subsystems after manufacturing or installation of all components directly connected to the IO pipe (PBS26) at the interface point without reducing the initial pressure: PED [25].
5	PO	Minimum pressure of the cooling water returning back into the outlet pipe at the interface point.

Table 18. Characteristics of the conveyed fluid in terms of pressure at the interface with the cooling water system.

13.1.5.3 Parameters in the Contractors pipe in case of using a pressure limiting or relief device downstream the interface point with the IO's pipes

The parameters in the table below are the parameters in the Contractors pipe system in case the Contractor uses a pressure relief or pressure limiting device after the interface point with IO.

The pressures in the table below shall be considered downstream any eventual pressure relief or pressure limiting device installed by the Contractor after the interface point with IO

N°	Parameter	Definition
1	PS'	Maximum Allowable Pressure in the Contractor pipe in case the Contractor uses a pressure limiting or pressure relief device downstream the interface point with IO. This value is the highest-pressure value expected in the Contractors pipe system downstream an eventual pressure limiting or pressure relief device installed by the Contractor considering all the incident/accidents/startup/shunt down and transient changes of the pressure limiting or pressure relief valve of the Contractor: PED
2	PC'	Calculation or design pressure for the design or calculation of all mechanical simulation of the resistance of all components in the pipe system of the Contractor downstream an eventual pressure limiting or pressure relief device installed by the Contractor downstream the interface point with IO: PED
3	PN'	Nominal steady state pressure in the pipe system of the Contractor downstream an eventual pressure limiting or pressure relief device installed by the Contractor after the stabilization of the pressure limiting or relief device.
4	PT'	Minimum test pressure used during the testing of the components of the system or subsystems after manufacturing or installation in the pipe system of the Contractor downstream an eventual pressure limiting or pressure relief device installed by the Contractor : PED
5	PO'	Minimum pressure of the cooling water returning back into the outlet pipe at the interface point

Table 19. Characteristics of the conveyed fluid in terms of pressure in case of using a pressure limiting or relief device.

13.1.5.4 Values of parameters

The values of the parameters are extracted from reference [24] and are given in the table below.

N°	Parameter	Symbol	Formula	Value	Unit	Remark
1	Pressure at the interface with IO. Upstream all the components in the scope of the Contractor.	PS				
2		PC		1.5	MPa	IO assumes no additional margin is necessary
3		PN		0.68	MPa	
4		PT	$PT = 1.5PS$	2.25	MPa	The margin 1.5 envelopes ANNEX I §7.4 of PED
5		PO		0.28	MPa	
6	Pressure downstream PRD or PLD.	PS'		Defined by the Contractor	MPa	Equals to the set point of the PRD or PLD
7		PC'	$PC' = 1.2PS'$		MPa	The margin 1.2 envelopes ANNEX I §7.3 of PED
8		PN'		Defined by the Contractor	MPa	
9		PT'	$PC' = 1.5PS'$		MPa	The margin 1.5 envelopes ANNEX I §7.4 of PED
10		PO		0.28	MPa	

Table 20. Values of the coolant pressures for VS3-PS pipe components in B13

13.1.6Seismic Loads

This section provides the values of the FRS to consider for the design of the components of the VS3-PS system fixed on the base supports.

The base supports for the components of the VS3-PS system installed in B13 are:

- B13 Ground (The B13 concrete slab)
- The B13 main steel structure

Based on the seismic classification (SC2) given in §5, the FRS to consider for the design of the components of the VS3-PS system are SL1, SL2, SMHV according to §7.1.1 in document in reference [05].

Depending on the type of the component and its location in the B13, the Contractor shall extract the spectra of the corresponding damping from the document in reference [16].

The Contractor shall calculate the FRS at the missing damping by performing the following interpolation: reference [05], §7.1.2.1

$$(A_{i-1} - A_i)/ (A_{i-1} - A_{i+1}) = \ln(\zeta_{i-1}/\zeta_i)/ \ln(\zeta_{i-1}/\zeta_{i+1})$$

$$\rightarrow A_i = A_{i-1} - (A_{i-1} - A_{i+1})^* \ln(\zeta_{i-1}/\zeta_i)/ \ln(\zeta_{i-1}/\zeta_{i+1})$$

A_{i-1}, A_i, and A_{i+1} are the spectral acceleration for the damping value ζ_{i-1}, ζ_i, and ζ_{i+1}.

- SMHV FRS is obtained by multiplying SL2 by 0.73.
- Unless a specific SMHV analysis is performed, seismic response to SMHV event may be obtained by multiplying the results from SL-2 by a factor 0.73.
- Unless a specific SL1 analysis is performed, seismic response for SL1 can also be obtained by dividing SL2 response by 3.

13.1.6.1 Damping for SL1, SMHV and SL2

According to document in reference [05], the damping to consider are the following.

System		SL-1	SMHV and SL-2
General	Welded steel or bolted steel with friction connection	3%	4%
	Bolted steel with bearing connection	5%	7%
Piping	Piping System	3%	4%
Electrical distribution	Cable tray System - Maximum Cable loading	7%	10%
	Cable tray System - Empty	5%	7%
	Conduit System - Maximum Fill	5%	7%
	Conduit System - Empty	3%	5%
Mechanical and electrical components	Motors, Fans, protection housings	2%	3%
	Pressure vessels, Heat exchangers, Pumps and Valves Bodies	2%	3%
	Electrical Cabinets, Panels, Motor Control Centers	2%	3%

Table 21: Damping for SL1, SMHV and SL2

13.1.6.2 Spectra to use for components fixed on the ground in B13

According to document in reference [17],§2,

"For the equipment which is directly fixed to the foundation level or close to the ground (3m or less below the first storey, first storey excluded), the envelop of the ground seismic response spectrum and the Floor Response Spectra at the equipment location will be used:"

For these components fixed on the ground floor, the design spectra to consider for the horizontal direction is the envelope of the date calculated in sheet "B13-SL2" and sheet "SL2 Spectra" in the Excel sheet in reference [16]. The vertical acceleration is equal to the 2/3 of the horizontal one according to reference [05] §7.1.1.1.

For information the FRS at 3% for components fixed on the B13L1 is given below.

FRS at other damping can be extracted as well from Excel sheet in reference [16].

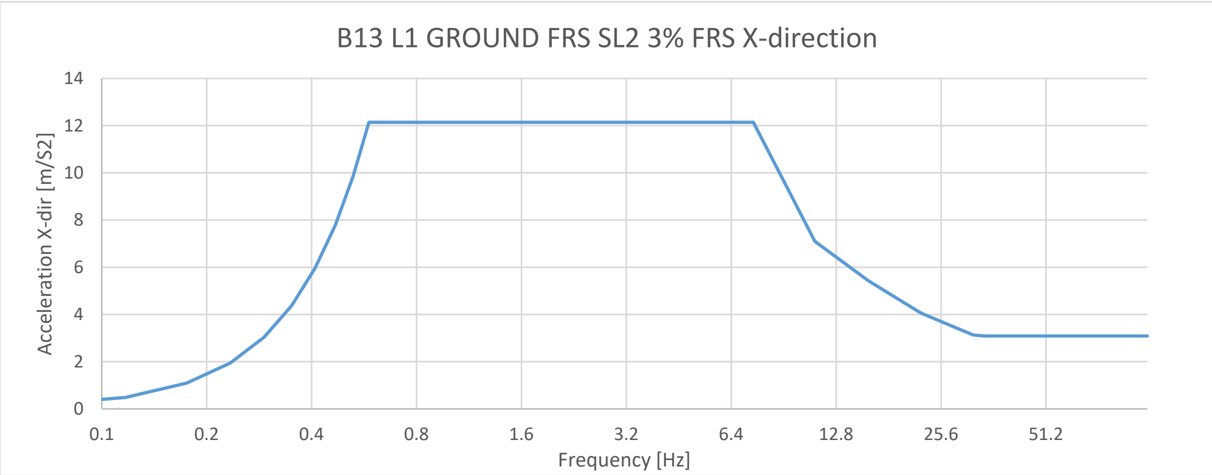

Figure 7: B13 L1 FRS GROUND SL2 3% X-direction

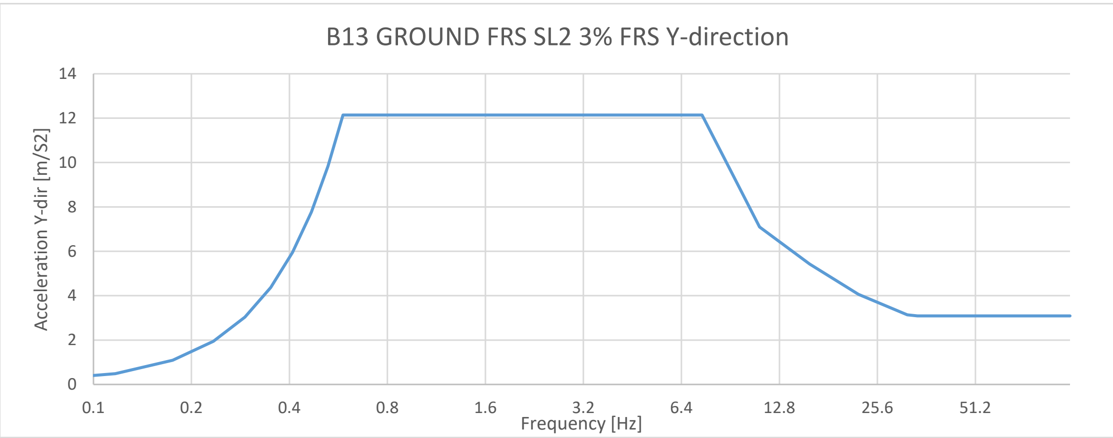

Figure 8: B13 L1 GROUND FRS SL2 3% Y-direction

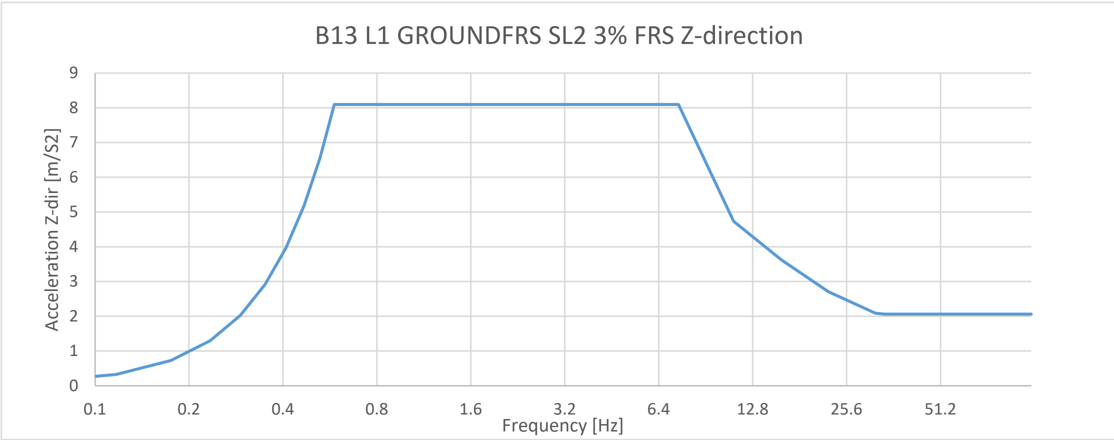

Figure 9: B13 L1 GROUND FRS SL2 3% Z-direction

13.1.6.2.1 Spectrum parameters for FRS at 3% damping in B13 L1 on the ground floor extracted from "B13-SL2" and sheet "SL2 Spectra" in the Excel sheet in reference [16]

Ground acceleration	aN [m/s2] =	3.090150			
Height of the building	H [m] =	59.00	alpha=	1.50	(Frame=1 and Wall or diagonal=1.5)
Position of the equipment	z [m]=	0.00	Pp=	1.6	
	z/H [-] =	0			
Damping of the building (%)	D1 [%] =	7.0	n1=	0.912871	
Damping of equipment (%)	D2 [%] =	3.0	n2=	1.290994	
Reduction factor for the building	q [-] =	1.5	KTmax=5·n1·n2	**5.892557**	
Fundamental frequency of the building	f1 [Hz] =	0.73			
Last significative frequency of the building	f2 [Hz] =	6.17			
Cut-off frequency	fc [Hz] =	16.7			
Frequency to consider to calculate Sa and Ra	f [Hz] =	0.73			
Ra factor	Ra [-] =	1.00	The Ra factor has to be calculated with the correct value of damping for the building		
ZPA at equipement location	**Sa [m/s2] =**	**2.0601**			
Frequency of the equipment	fe [Hz] =	3.50			
Spectral acceleration for the equipment	Sa_h [m/s2] =	12.1393			
	Sa_v [m/s2] =	4.1202			

$$S_e(T_p) = \frac{a_N}{q_p}\sqrt{1+P_p^2\ R_a^2(T_p)\left(\frac{z}{H}\right)^{2\alpha}}$$

Table 22: Spectrum parameters for FRS at 3% damping in B13 L1 on the ground floor extracted from "B13-SL2" in the Excel sheet in reference **[16]**

Frequency building [Hz] =	0.730
Tbuilding [s] =	1.36986
Damping [%] =	7.0
Spectral acceleration [m/s2] =	**1.2842**
Ra (>=1) [-] =	**1.0000**
an [m/s2] =	**3.0902**

Table 23: Spectrum parameters for FRS at 3% damping in B13 L1 on the ground floor extracted from sheet "SL2 Spectra" in the Excel sheet in reference **[16]**

13.1.6.2.2 Spectrum data for FRS at 3% damping in B13 L1 on the ground floor extracted from “B13-SL2” and sheet “SL2 Spectra” in the Excel sheet in reference [16]

Floor response spectra (horizontal directions)		
Damping value for equipment =	3.0%	
Frequency [Hz]	Spectral acceleration [m/s2]	KT factor [-]
0.000	0.000000	0.00
0.058	0.121393	0.06
0.117	0.485570	0.24
0.175	1.092533	0.53
0.234	1.942281	0.94
0.292	3.034814	1.47
0.350	4.370132	2.12
0.409	5.948235	2.89
0.467	7.769124	3.77
0.526	9.832797	4.77
0.584	12.139256	5.89
3.994	12.139256	5.89
7.404	12.139256	5.89
9.263	9.363183	4.55
11.122	7.096623	3.44
12.982	5.181235	2.52
14.841	3.522659	1.71
16.700	2.060100	1.00
33.400	2.060100	1.00

Table 24: Spectrum data for FRS at 3% damping in B13 L1 on the ground floor extracted from “B13-SL2” in the Excel sheet in reference **[16]**

SL2 enveloppe SMS paleo ground horizontal						
Frequency_Hz	2.0% ENV_m/s^	3.0% ENV_m/s^2	4.0% ENV_m/s^2	5.0% ENV_m/s^2	6%ENV_m/s^2	7.0% ENV_m/s^2
	2	3	4	5	6	7
0.1	0.022563	0.022563	0.022563	0.022563	0.022563	0.022563
0.25	0.319175688	0.290804044	0.270674042	0.25506	0.242302398	0.231516
0.4	0.738141863	0.680216424	0.63911767	0.607239	0.58119223	0.55917
1	2.475862862	2.23588604	2.065619775	1.933551	1.825642953	1.734408
1.42	3.415066083	3.104160151	2.883568881	2.712465	2.572662949	2.454462
2	4.802167245	4.296799306	3.938235047	3.660111	3.432867108	3.271635
2.82	6.130211541	5.513815797	5.076476057	4.737249	4.460080313	4.263426
3.98	7.562056799	6.766995622	6.20289074	5.765337	5.407829563	5.154174
5.62	9.894826924	8.716911248	7.881166775	7.232913	6.703251099	6.32745
7.94	9.589420098	8.553160587	7.817922762	7.247628	6.781663251	6.451056
11.22	7.864603583	7.120589672	6.592703402	6.183243	5.848689492	5.61132
15.84	5.859184381	5.427834978	5.121787707	4.884399	4.690438304	4.552821
22.38	4.234857356	4.062572832	3.940335016	3.84552	3.768050491	3.713085
31.62	3.146516824	3.135031189	3.126882001	3.120561	3.115396366	3.111732
34	3.09015	3.09015	3.09015	3.09015	3.09015	3.09015
100	3.09015	3.09015	3.09015	3.09015	3.09015	3.09015

Table 25: Spectrum data for FRS at 3% damping in B13 L1 on the ground floor extracted from sheet “SL2 Spectra” in the Excel sheet in reference **[16]**

13.1.6.3 Spectra to use for components fixed 3m above the ground in B13

For the components fixed 3m above the ground floor, the design spectra to consider is FRS calculated in sheet "B13-SL2" in the Excel sheet in reference [16].

The height of the component with regard of the B11 ground shall be set in case I8 and the damping shall be set in case I11 in the Excel sheet in reference [16].

For the vertical acceleration transferred to the equipment, the equivalent static value in line 28 of in the Excel sheet in reference [16] shall be considered.

For information the FRS at 3% to consider for a component fixed 20m above the L1 level in B13 is given below.

Other FRS at different levels can be extracted as well from Excel sheet in reference [16]

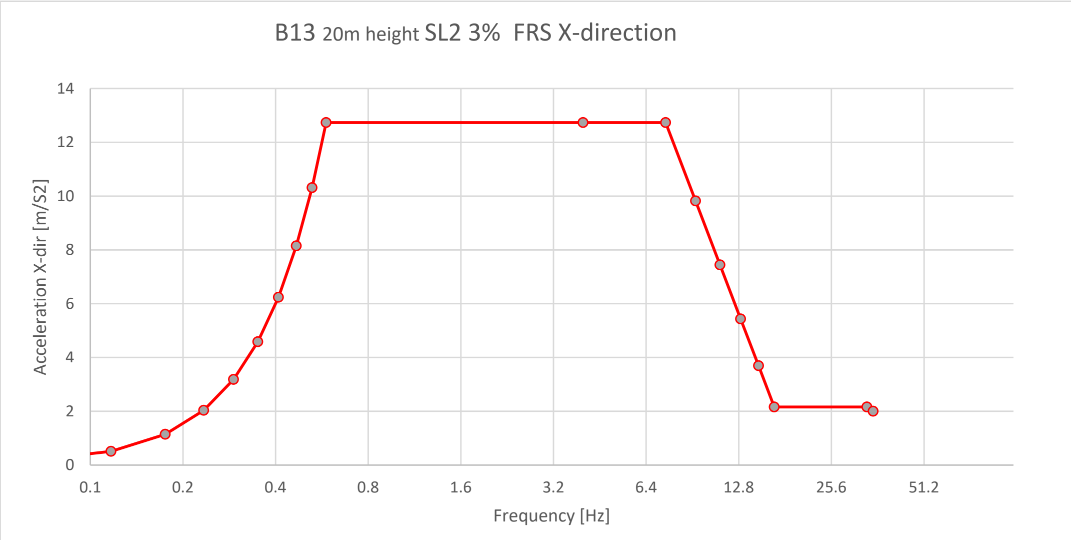

Figure 10: B13 20m height FRS SL2 3% X-direction

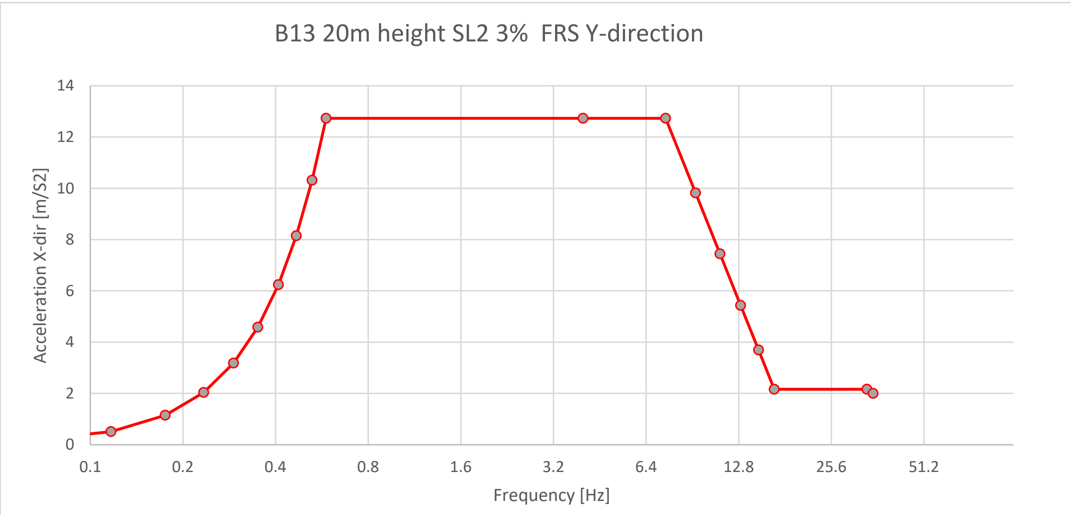

Figure 11: B13 20m height FRS SL2 3% Y-direction

The vertical acceleration transferred to the equipment is the equivalent static 4.12 m/s2.

13.1.6.3.1 Spectrum parameters for FRS at 3% damping in B13 at 20m above the ground floor extracted from "B13-SL2" in the Excel sheet in reference [16]

The spectrum parameters considered for the generation of the FRS at 20m above the floor is the following.

The data are set in the sheet "B13-SL2" in the Excel sheet in reference [16] as follows.

Ground acceleration	aN [m/s2] =	3.090150		
Height of the building	H [m] =	59.00	alpha=	1.50 (Frame=1 and Wall or diagonal=1.5)
Position of the equipment	z [m]=	20.00	Pp=	1.6
	z/H [-] =	0.338983		
Damping of the building (%)	D1 [%] =	7.0	n1=	0.912871
Damping of equipment (%)	D2 [%] =	3.0	n2=	1.290994
Reduction factor for the building	q [-] =	1.5	KTmax=5·n1·n2	**5.892557**
Fundamental frequency of the building	f1 [Hz] =	0.73		
Last significative frequency of the building	f2 [Hz] =	6.17		
Cut-off frequency	fc [Hz] =	16.7		
Frequency to consider to calculate Sa and Ra	f [Hz] =	0.73		
Ra factor	Ra [-] =	1.00	The Ra factor has to be calculated with the correct value of damping for the building	
ZPA at equipement location	**Sa [m/s2] =**	**2.160374**		
Frequency of the equipment	fe [Hz] =	3.50		
Spectral acceleration for the equipment	Sa_h [m/s2] =	12.7301		
	Sa_v [m/s2] =	4.1202		

$$S_a(T_p) = \frac{a_N}{q_p}\sqrt{1+P_p^2\; R_a^2(T_p)\left(\frac{z}{H}\right)^{2\alpha}}$$

Table 26: Spectrum parameters for FRS at 3% damping in B13 at 20m above the ground floor extracted from "B13-SL2" in the Excel sheet in reference **[16]**

13.1.6.3.2 Spectrum data for FRS at 3% damping in B13 at 20m above the ground floor extracted from "B13-SL2" in the Excel sheet in reference [16]

Floor response spectra (horizontal directions)		
Damping value for equipment =	**3.0%**	
Frequency [Hz]	**Spectral acceleration [m/s2]**	**KT factor [-]**
0.000	0.000000	0.00
0.058	0.127301	0.06
0.117	0.509205	0.24
0.175	1.145711	0.53
0.234	2.036820	0.94
0.292	3.182532	1.47
0.350	4.582846	2.12
0.409	6.237762	2.89
0.467	8.147281	3.77
0.526	10.311403	4.77
0.584	12.730127	5.89
3.994	12.730127	5.89
7.404	12.730127	5.89
9.263	9.818931	4.55
11.122	7.442047	3.44
12.982	5.433429	2.52
14.841	3.694122	1.71
16.700	2.160374	1.00
33.400	2.160374	1.00

Vertical acceleration transferred to the equipement (equivalent static)	
Sav [m/s2]=	**4.1202**

Table 27: Spectrum data for FRS at 3% damping in B13 at 20m above the ground floor extracted from "B13-SL2" in the Excel sheet in reference **[16]**

13.1.7 EM Loads

Two electromagnetic loads are relevant:

13.1.7.1 The static and Transient Magnetic field due to the operation of the TKM machine.

The Field Maps is provided in document in reference [23]. The effect of the static magnetic field from the TKM machine on the PBS41 components will be deduced from the provided data.

13.1.7.2 The magnetic field produced by the VS3-PS components due to their operation.

The corresponding loads on the structure will be calculated by the Contractor when the design of the system is finalized.

13.1.8 Structural Loads due to Component Operation

All the load triggered internally during the operation of PBS41 VS3 systems in B13 will be specified by the Contractor.

13.2 Loads in Incident and Accident Events

13.2.1 External accidents or incidents

External accidents are accidents outside the VS3-PS system that doesn't depend on the VS3-PS system. These accidents are listed in §13.7

13.2.1.1 Fire external to VS3-PS system

Fire Safety analysis has been requested for the B13. The data for this analysis are not available at current design phase. This study will determine the fire temperature and pressure, if relevant, to consider during the design of components to withstand fire loads of category IV described in §14.1

13.2.1.2 Loss of HVAC

In case of loss of HVAC in B13, the operation of the VS3-PS will be stopped if over-temperatures are detected in critical components. That still means that in case of loss of HVAC, the VS3-PS operates at elevated ambient and internal temperatures $T_{elev}[°C]$ during a time $t_c[s]$ before such over-temperature protections have triggered.

Should it be relevant for the design of the VS3-PS, the Contractor of the VS3-PS shall estimate and provide the values $T_{elev}[°C]$ and t_c[s] when the design of the VS3-PS will be finalized. T_{elev} $[°C]$ is a thermal load that the Contractor of the VS3-PS shall declare as internal load (13.2.2) and shall provide the category (*IINC, IEMR or IACC*) of this thermal loads according to the description given in §14.1. The Contractor of the VS3-PS shall then consider $T_{elev}[°C]$ in the load combinations in §14.3.

After over-temperature protections have triggered, the VS3-PS operation will be stopped, after which the VS3-PS components may remain exposed to elevated ambient temperature.

13.2.2 Internal accidents or incidents

Internal accidents or incidents are accidents and incidents due to the operation of the VS3-PS system.

The Contractor will develop the incident and accident scenarios due to the operation of the VS3-PS system and will estimate and quantify the loads triggered by this internal accident and incidents.

The Contractor will use these loads during the design of the VS3-PS system and will be considered in the relevant load categories.

13.2.2.1 Loads triggered by internal incidents (IINC)

Incident events are likely to happen. Loads resulting from incidents are called *internal incident loads* and are noted $IINC$.

The internal incidents loads are category II.

13.2.2.2 Loads triggered by internal emergency (IEMR)

Emergency events are events that are unlikely to happen. Loads resulting from emergency events are called *internal emergency loads* and are noted $IEMR$.

The internal emergency loads are category III.

13.2.2.3 Loads triggered by internal accident (IACC)

Accident events are events that are very unlikely to happen. Loads resulting from accident events are called *internal accident loads* and are noted $IACC$.

The internal accident loads are category IV.

13.3 Thermal loads

13.3.1 Fire loads

Fire is an accident and is escribed in §13.2

13.3.2 Thermal load of the cooling pipe system for VS3-PS system

13.3.2.1 Temperature parameters of the cooling pipes

The temperature parameters are defined here after

N°	Parameter	Definition
1	TS	Maximum supply temperature of the cooling water provided by PBS 26.
2	TC	Calculation or design temperature for the design or calculation or all mechanical simulation of the resistance of all components in the pipe system of the Contractor: PED [25].
3	TO	Maximum return temperature of the cooling water supplied to PBS 26. This is referred to as Maximum Allowable Temperature of cooling water expected in the outlet pipe back to the IO cooling water system the interface point. PED [25].

Table 28. Characteristics of the conveyed fluid in terms of temperature

13.3.2.2 Value of the temperature parameters of the cooling pipes

The values of the temperature parameters of the cooling pipes are extracted from reference [24] and are given in the table below:

N°	Parameter	Symbol	Formula	Value	Unit	Remark
1	Temperatures in the system.	TS		31	°C	
2		TC		60	°C	
3		TO		33	°C	

Table 29. Values of the temperature for VS3-PS pipe components in B13

The cooling water return temperature TO is defined as Maximum Allowable Temperature in the framework of PED [25].

13.3.3 Environmental temperature

13.3.3.1 Temperature during assembly in B13

According to document in reference [06] §5.1.6, the quasi permanent value of the temperature inside rooms of concrete buildings and isolated steel buildings when HVAC operates is $\Theta_m = 21°$ The temperature variation in buildings in general is given in document in reference [06] §5.1.6. table 5-3 and the temperature variation in the assembly hall is given in SRD in reference [13].

The average of given values in the year is 21° which is the average temperature in France according to §C 1.2.1.5 in French Construction Code in reference [30].

Period of the year	Temperature [°C]		
	Minimal	maximal	Average
Summer	25	28	26.5
Winter	12	18	15
Average	18.5	23	**21**

Table 30: Temperature in B13 during assembly

It is assumed that the installation of equipment in B13 is realized within ambient temperature specified above $\Theta_{mINST} = 21°$

13.3.3.2 Temperature during operation in B13

The ambient temperature in B13 during the operation of the VS3-PS is 35°C [06]. The HVAC system is designed for such temperature following data provided in document in reference [11].

13.4 *Nuclear loads*

According to document in reference [14], the nuclear heating in the material SS316L(N) of the structures in the bioshield is 1e-07 W/Cm3.

This value has no effect of the steel material in the bioshield. In B13 the value of nuclear heating is even lower.

The effect of the Nuclear Heating is negligible for PBS41 VS3-PS structures in B13. Radiation does not affect mechanically the Steel Structures and is ignored.

13.5 Specific Loads or Conditions

13.5.1.1 Corrosion

The standards listed in §6 specify the delivery conditions: the reduction on dimension due to corrosion will be provided following the selected standard for provision of the steel components.

13.5.1.2 Flood

According to *Preliminary Safety Report* in reference [15], the design of all ITER systems including PBS41 VS3-PS components, shall include provisions to minimize the potential for other hazards such as flooding that could challenge confinement systems.

According to this document Internal flooding is due to fire-fighting water or cooling loop pipe break. PBS41 VS3-PS components, sensitive components, monitors, cubicles, and cabling shall be located above the assumed flooding level of 0.1 m in the rooms.

13.5.1.3 Humidity

According to document in reference [18], humidity is 55%. For the design of the Power supplies a maximum envelope humidity 70% is considered.

13.5.1.4 Tolerance

Tolerance on dimension or physical quantities must be considered for the verification of the structural integrity of the equipment of PBS41 VS3-PS components.

The standards listed in §6 specify the delivery conditions: tolerance on the nominal dimensions will be provided following the selected delivery standard.

13.6 Interfaces Loads

Interface loads are loads transferred by surrounding systems not in the scope of the system considered.

13.6.1Relative displacement between VS3-PS steel structure and B13 steel structures

The VS3-PS steel structure is located close to the columns of the B13 steel structure.

The displacements of the B13 steel structure will be provided on the table below.

VS3-PS steel structure's displacement with regard to the L1 ground in TGCS												
	Category I loads			Category II loads			Category III loads			Category IV loads		
Levels	dx [mm]	dy [mm]	dz [mm]	dx [mm]	dy [mm]	dz [mm]	dx [mm]	dy [mm]	dz [mm]	dx [mm]	dy [mm]	dz [mm]
B13L1+5m												
B13L1+10m												
B13L1+15m												
B13L1+20m												
B13L1+25m												
B13L1+30m												
etc												

Table 31: Displacements of theVS3-PS steel structure in B13 (TBD)

13.6.2Interface loads with PBS26

The interface loads with PBS26 will be specified later in [24] by PBS26 after completion of the design of PBS26 pipes system.

It is expected that, after the completion of the design of PBS26 piping system, the table below will be completed and the load sets at the determined interface points will be provided by PBS26 for each interface point.

Points	Interface loads fromPBS26 at interface points (TBD)					
	Fx [N]	Fy[N]	Fz [N]	Mx [Nm]	My [Nm]	Mz [Nm]]
Inlet						
Outlet						
Other interface points if relevant						

Table 32: Load sets at interface loads with PBS26

13.6.3 Interface loads with the Extension Busbars

At current design phase, the Extension Busbars are not yet designed.

The load participation in the interface loads with the Extension Busbars will be provided later by the Contractor of the Extension Busbars after completion of their design

The VS3-PS and the Extension Busbars will share the connection loads at the interface point as illustrated in Figure 12.

The concept illustration of interface between VS3-PS and VS3-PS Extension Busbars is presented in in Figure 12.

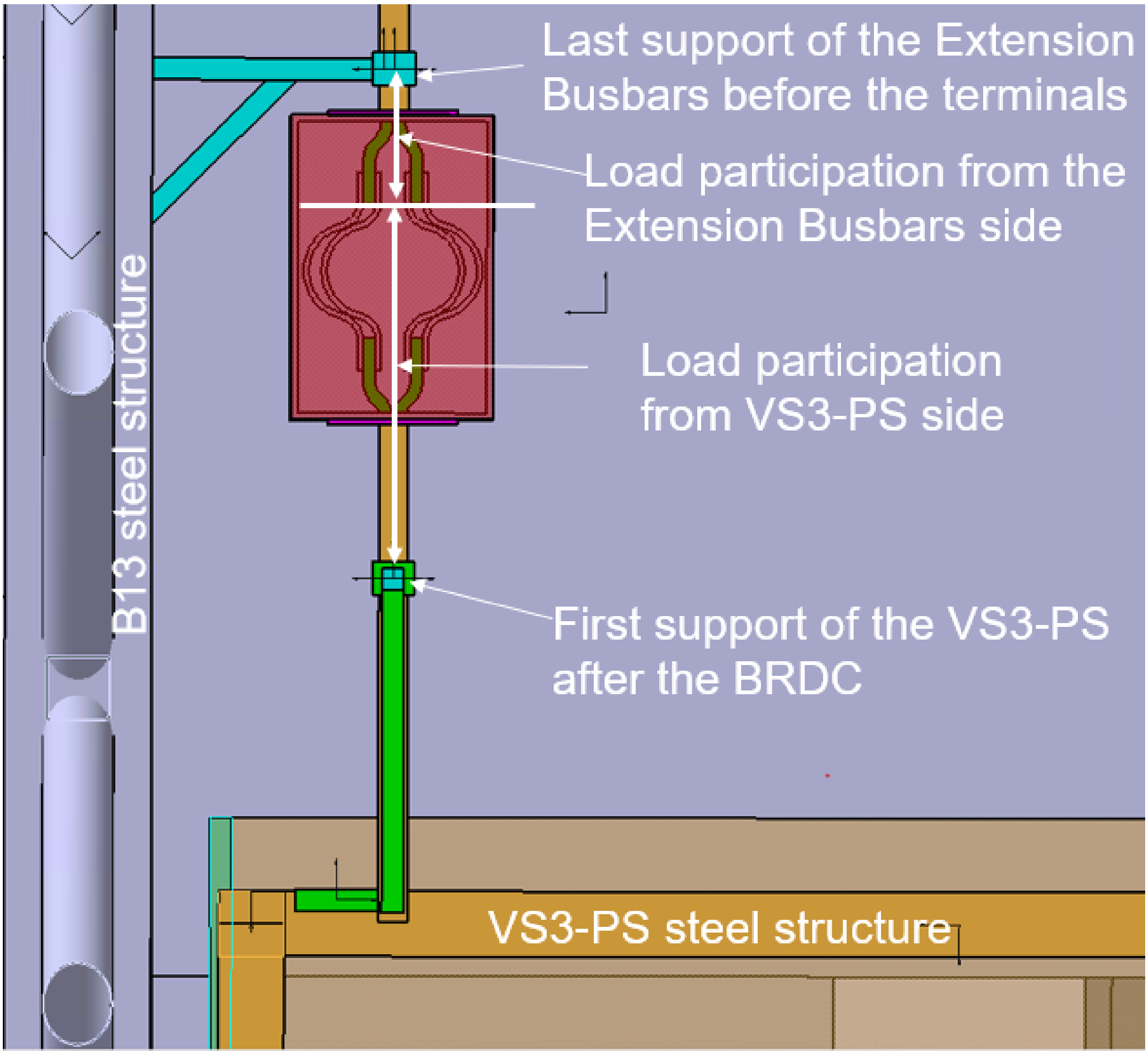

Figure 12. Concept illustration of interface load between VS3-PS and VS3-PS Extension Busbars

After the completion of the design of Extension Busbars, the table below will be completed and the load sets and their categories from Extension Busbars side at the *N* determined interface points by Extension Busbars will be provided to the VS3-PS.

These loads shall be then considered by the Contractor of the VS3-PS as loads acting on the VS3-PS relevant components.

Points	Interface loads from Extension Busbars at interface points (TBD)					
	Fx [N]	Fy[N]	Fz [N]	Mx [Nm]	My [Nm]	Mz [Nm]]
1						
2						
•						
•						
•						
N						

Table 33: Load sets at interface loads with Extension Busbars

13.6.4Interface loads with the Drainage System

A drainage network is available in B13 for evacuation of non-contaminated wastewater.

The Contractor of the VS3-PS may connect to if they need to evacuate wastewater.

At current design phase, the Drainage system of the VSP-PS is not yet designed.

At current design phase, it is assumed that the Contractor will install a permanent Pressure Limiting Device (PLD) or a Pressure Relief Device (PRD) after the interface point with IO PBS26 pipes that will release the cooling water into the drainage system in case of overpressure.

The design and the setting point of such Pressure Limiting Device (PLD) or a Pressure Relief Device (PRD) should be much higher than the Nominal Pressure PN of the cooling water at the interface point with IO' PBS26 system. So, the Contractor may install a permanent drainage pipe represented in blue in the image below.

The interface with the existing IO'Drainage System will be specified at later stages.

Nevertheless, a concept of the connection to the cooling and drainage system is presented in the image Figure 6.

If relevant, the interface loads involved with Drainage System will be specified in the table below for the *K* interface pointe agreed by both IO and the Contractor of the VS3-PS

Points	Interface loads with Drainage System (TBD)					
	Fx [N]	Fy[N]	Fz [N]	Mx [Nm]	My [Nm]	Mz [Nm]]
1						
2						
•						
•						
•						
K						

Table 34: Load sets at interface loads with Drainage System

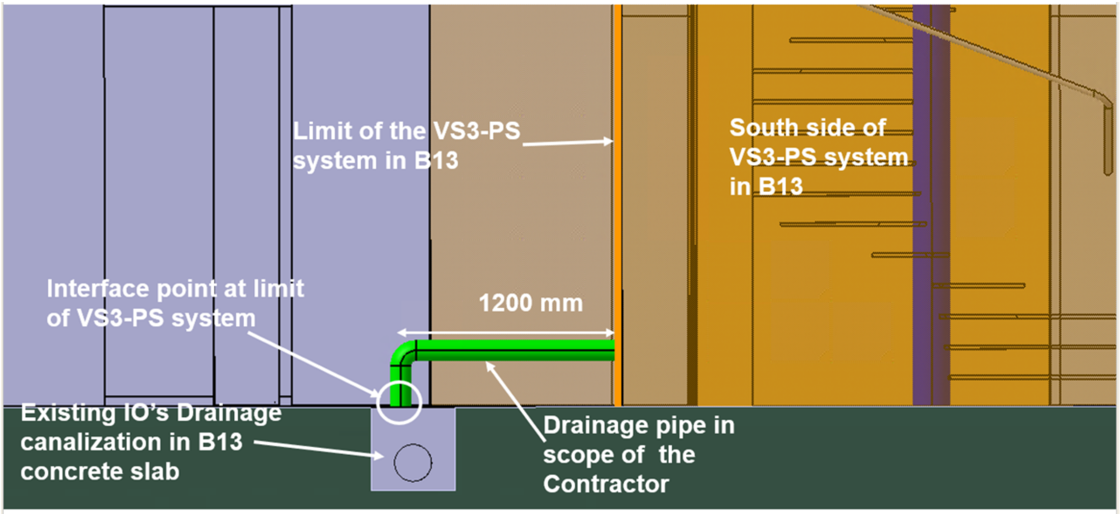

Figure 13. Concept: Illustration of the concept interface between existing IO's drainage system and VS3-PS

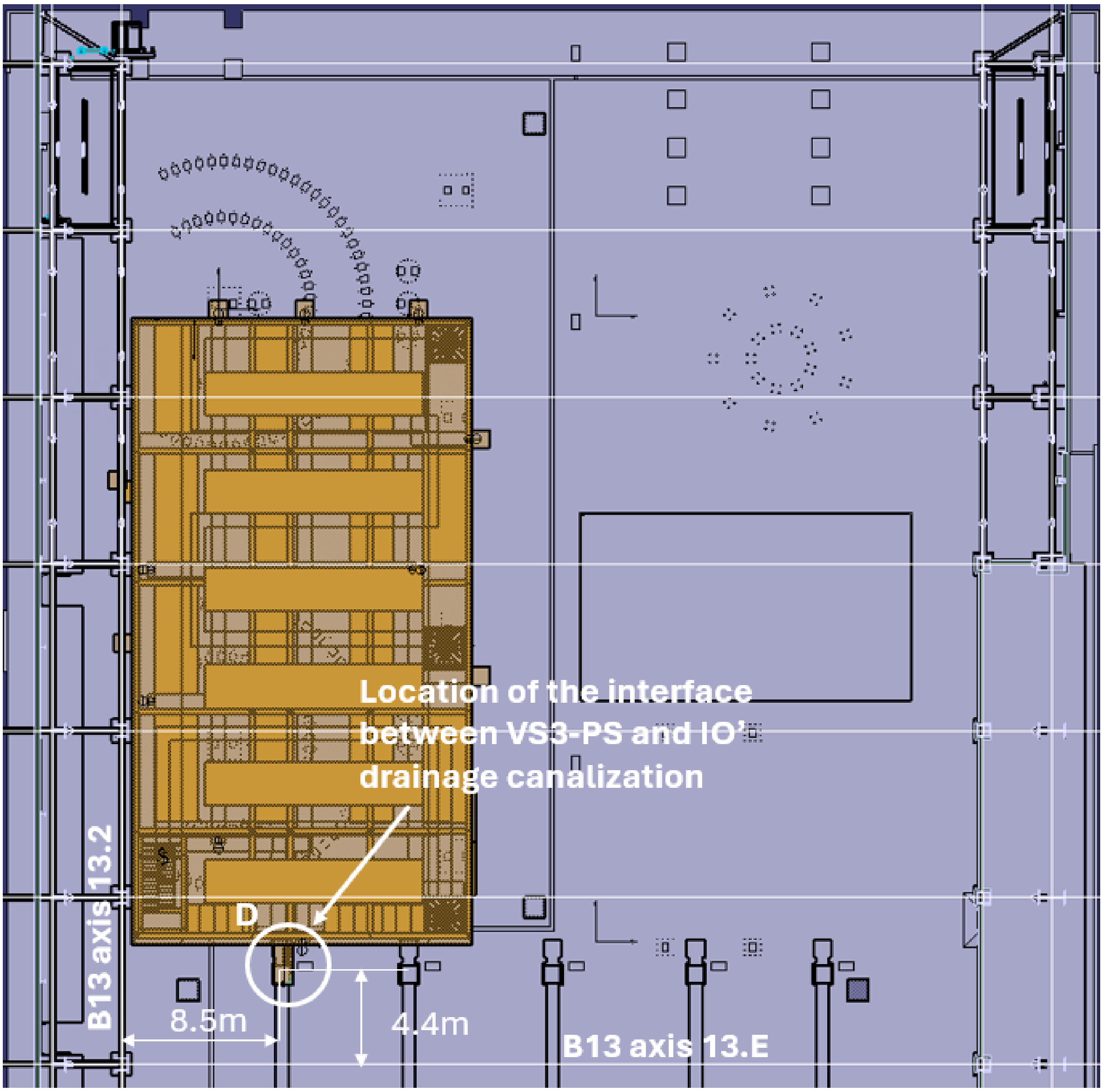

Figure 14. Location of the interface between existing IO's drainage system and VS3-PS

13.7 Not Significant Load Cases

The ITER Load Specifications [05] describes the following loads as non-impacting for VS3-PS components in B13.

13.7.1 1VV ICE

As specified in ITER Load Specification [05], VV ICE induces a pressure increase in the plasma chamber. This event does not affect VS3-PS components as they are outside the VV boundary.

13.7.2 Cr ICE

This does not affect VS3-PS components in B13.

13.7.3 Cr LOVA

As specified in [05] Cr LOVA causes a depressurization of the Cryostat. According to this document, it does not affect VS3-PS components in B13.

13.7.4 He Ingress in Gallery

This case is a Helium Spillage from the Magnets inside the Cryostat Space Room. This does not affect VS3-PS components in B13.

13.7.5 LOCA in Gallery

This event does not affect VS3-PS components in B13.

13.7.6 LOCA NB

This event affects the NB Cell. It is not related to B13.

13.7.7 LOCA in Vault

This event is not expected to affect the components in B13.

13.7.8 VV LOFA and IVC LOFA

Loss of forced flow accidents (LOFA) in VV and in-vessel components is caused by a loss of Forced Flow in the blanket and Divertor cooling circuits. It affects VV temperature but has negligible impact on components in B13.

13.7.9 Inertia Loads During

During LTM and installation of the VS3-PS components, structures may be lifted by crane. The lifting accelerations of the crane are supposed to be smooth to not be a design driving load.

14 Load Combinations

14.1 Categorization of Load Combinations

The table below gives the category of each type of load.

The load combinations are set by combining the loads in the table below. The calculation code provides the validation criteria for each category of load.

For each load combination, the criteria to consider is the criteria of the highest category of the combined loads.

N°	Category Load	Designation of Load	Damage limit	Recovery measures
1	-	Test Pressure	Elastic deformation	Service function
2	Category I	Pretention Load	Elastic deformation	Service function
3	Category I	Dead Weight	Elastic deformation	Service function
4	Category I	Design Pressure	Elastic deformation	Service function
5	Category I	Design Temperature	Elastic deformation	Service function
6	Category I	Magnetic Loads	Elastic deformation	Service function
7	Category I	Radiation Dose	Elastic deformation	Service function
8	Category I	Relative displacement due to thermal loads	Elastic deformation	Service function
9	Category I	Tolerance	Elastic deformation	Service function
10	Category II	SL1 Seismic Load	Elastic deformation	No special inspections shall be required expect for routine maintenance and minor adjustment.
11	Category II	Internal incidents	Elastic deformation	No special inspections shall be required expect for routine maintenance and minor adjustment.
12	Category III	SMHV Seismic Load	Large deformations in areas of structural discontinuity, such as nozzles, which may necessitate removal of the component from service for inspection or repair. Insignificant general permanent deformation of the structural component(s). General strains shall be within elastic limits.	The VS3-PS system may require major replacement of damaged component or major repair work. Nevertheless, the VS3-PS system maintains the specified minimum safety function during and after the events.
13	Category III	Internal emergency	Large deformations in areas of structural discontinuity, such as nozzles, which may necessitate removal of the component from service for inspection or repair. Insignificant general permanent deformation of the structural component(s). General strains shall be within elastic limits.	The VS3-PS system may require major replacement of damaged component or major repair work. Nevertheless, the VS3-PS system maintains the specified minimum safety function during and after the events.
14	Category IV	SL2 Seismic Load	Gross general deformations with some consequent loss of dimensional stability and damage requiring repair, which may require removal of component from service. Nevertheless, deformation shall not lead to structural collapse which could damage other components.	Gross damage to the VS3-PS system or component. No design consideration will be given for recovery. The recovery of the VS3-PS system may be judged from the severity of damage. This level of state is not expected to occur but is postulated for safety assessment.
15	Category IV	Internal accidents	Gross general deformations with some consequent loss of dimensional stability and damage requiring repair, which may require removal of component from service. Nevertheless, deformation shall not lead to structural collapse which could damage other components.	Gross damage to the VS3-PS system or component. No design consideration will be given for recovery. The recovery of the VS3-PS system may be judged from the severity of damage. This level of state is not expected to occur but is postulated for safety assessment.

Table 35: List of loads and load categories

Note on Table 35:

For all load categories, requirements on nuclear safety shall be met.

14.2 Damage limits.

The damage limits given in this document are provided for information. The Contractor may read the corresponding sections in the standards and adapt if needed the coefficients according to the final design of the VS3-PS components.

The damage limits analyzed here are related to the following components in the scope of this load specification.

The Table 36 below is based on the template provided in Table 4-2 of [05], and provides the damage limits that apply to each part in the scope of this load specification.

Component	Safety Class	Cat. I	Cat. II	Cat. III	Cat. IV	Test
PBS41 VS3-PS components	Non-SIC	Normal	Upset	Emergency	Faulted	Test

Table 36: Damage limits for load conditions according to 222QGL in [05]

The mechanical components of PBS41 VS3-PS system installed in B13 are not PIC components.

Nevertheless, they are classified as QC3 and SC2. They are required to keep functional during category I and II events.

Following category III events, they should be operational after review and checking.

Following category IV event, they are not required to be operational, but their stability should be guaranteed.

In the next, the correlation between the damage limits in Table 36 and the service level of design codes in Table 10 is detailed.

14.2.1 Correlation between damage limits and service levels of design codes

The possible design codes to use for the design for the mechanical aspect of PBS41 components in B13 are recalled here after.

N°	Field of application	Calculation code
1	Design of steel structures	EUROCODEs
2		ANSI/AISC 360
3	Design of pipes and pipe-supports	EN13480-3
4		ASME B31-1

Table 37: Calculation codes

14.2.2 Correlation between damage limits and service levels of EUROCODE 3

For the design as per Eurocode 3 in reference [31], the structural service level corresponding to each of the ITER loading categories is given in EN 1990 in reference [32] as follows:

- Reversible Serviceability Limit State: Serviceability limit states where no consequences of actions exceeding the specified service requirements will remain when the actions are removed.
- Irreversible Serviceability Limit State: Serviceability limit states where some consequences of actions exceeding the specified service requirements will remain when the actions are removed.
- Ultimate Limit State: States associated with collapse or with other similar forms of structural failure.

The correlation between damage limits and service levels for the Eurocode 1993 is the following.

Categories	Damage limit	Service level in Eurocode 3
Cat. I	Normal	Reversible Serviceability Limit State
Cat. II	Upset	Reversible Serviceability Limit State
Cat. III	Emergency	Irreversible Serviceability
Cat. IV	Faulted	Ultimate Limit State
Test	Test	Irreversible Serviceability*
*Minor plastic deformation associated with plastic accommodation in local areas are allowed provided they do not compromise the serviceability		

Table 38: Correlation between damage limits and service levels for Eurocode 3

14.2.3 Correlation between damage limits and service levels of ANSI/AISC 360

For ANSI/AISC 360 in reference [34], the service levels are considered in term of ponderation coefficients on the different loads as follows:

According to ASCE-16 in reference [39], coefficients are applied to each type of load, then the result is compared to the allowable stress given in ANSI/AISC 360 §4.

The annotation A, Ax, D, E, F, T in the table below come from ASCE-16 in reference [39], and used only in this table.

N°	Category Load	Designation of Load	Annotation	Coefficient in the load	Remark
1	-	Test Pressure	F	1	§2.3.1 ASCE
2	Category I	Pretention Load		1	§2.3.5 ASCE
3		Dead Weight	D	1	
4		Design Pressure	F	1	§2.3.1 ASCE
5		Design Temperature	T	0.75	§2.4.4 ASCE
6		Baking Temperature	T	0.75	§2.4.4 ASCE
7		Baking Pressure	F	1	§2.3.1 ASCE
8		Reaction Force		1	§2.3.5 ASCE
9		Payload loads (live loads)	D	1	§2.4.1 ASCE
10		Magnetic loads		1	§2.3.5 ASCE
11		Radiation loads		1	§2.3.5 ASCE
12		Anchor displacement	T	0.75	§2.4.4 ASCE
13		Tolerance		1	
14	Category II	SL1 Seismic Load	E	0.7	§2.4.5 ASCE
15	Category III	SMHV Seismic Load	E	0.7	§2.4.5 ASCE
16	Category IV	SL2 Seismic Load in	E	0.7	§2.4.5 ASCE
17		Seismic displacement	T	0.75	§2.4.4 ASCE
18		Acceleration Transp.	A_x	1	§2.5.2.1 ASCE
19		Fire Temperature	T	0.75	§2.4.4 ASCE
20		Fire Pressure	T	0.75	§2.4.4 ASCE

Table 39: Correlation between load categories and service levels for ANSI/AISC 360

Annotation	Coefficient in the load
F	Pressure loads
D	Dead loads
T	Temperature
E	Seismic
A_x	Acceleration

Table 40: Definition of annotations

14.2.4 Correlation between damage limits and service levels of EN13480

For EN1348 in reference [47], the correlation between the damage limit and the service level is given in term of ponderation coefficients k applied to the allowable stress of each category of loads.

14.2.4.1 For pipes

In accordance with EN13480-3 - § 5.2 in reference [26], for materials conform to the requirements of EN13480-2 in reference [26], the Allowable Nominal Stress shall be defined as follows:

$$f = \min\left\{\frac{R_{eHt}}{1.5}\ or\ \frac{R_{p0.2t}}{1.5};\frac{R_m}{2.4}\right\}$$ for carbon steel and stainless steel with A < 30%

$$f = \frac{R_{p0.1t}}{1.5}$$ for stainless steel with A > 35%

$$f = \min\left\{\frac{R_{p0.1t}}{1.5};\frac{R_m}{2.4}\right\}$$ for stainless steel with 35% ≥ A ≥ 30%

Where:

R_{eHt} is the minimum specified value of upper yield strength at calculation temperature.

$R_{p0.1t}$ is the minimum specified value of 0.1% proof strength at calculation temperature.

$R_{p0.2t}$ is the minimum specified value of 0.2% proof strength at calculation temperature.

R_m is the minimum specified value of tensile strength at room temperature.

These equations are applicable only when the design stress is time independent.

Coefficients applied on allowable stresses according to EN13480																			
Combinations according to EN13480	Type of loads										Iter load Category	Allowable stresses							Reference in EN13480
	Dead weight	Design pressure	Test pressure	Thermal	Other sustained	Displacement		SL1	SMHV	SL2		f_f	f_a	f_e	f_f+f_a	$1.2f_f$	$1.3f_f$	$1.8f_f$	
						Normal	Seismic												
1	X	X									I	X							§12.3.2
2	X				X						I	X							§12.3.2
3	X		X								I			X					§12.3.2
4				X							I		X						§12.3.4
5	X	X		X							I				X				§12.3.4
6	X	X			X			X			II	X							§12.3.3
7	X	X			X				X		III						X		§12.3.3
8	X	X			X					X	IV							X	§12.3.3
9	X	X				X					I	X							§12.3.3
10	X	X					X				IV							X	§12.3.3

Table 41: Correlation between the damage limit the service level according to in EN 13480

f_f is the design stress for flexibility analysis in MPa

f_e is the allowable stress range for test conditions $f_e = 0.95R_{eHtest}$ where R_{eHtest} is the yield stress at test temperature.

f_a is the allowable stress range in equation 12.1.3-1

The ponderation coefficients k are summarized below for NSR – (NON-PIC), SC2 components according to §12.3 in EN 13480 reference [26].

Seismic Class	**SC2**				
Safety Class	Test	Normal	Upset	Emergency	Faulted
NSR – (NON-PIC)	0.95	1	1.2	1.3	1.8

Table 42: Coefficients k

14.2.4.2 For supports.

14.2.4.2.1 For plate or shell type supports

According to EN 13480-3 - §13.3.6.3 - Tableau 13.3.6-1 in reference [26], the coefficients applied on the allowable stresses are the following.

Situation	**Category**	**Stresses Type**	
		Stresses Type	Allowable Stresses
Normal	I , II	σ_a	1,0.f
		σ_b	1,5.f
		τ	0,6.f
		σ_e	1,5.f
Emergency	III	σ_a	1,2.f
		σ_b	1,8.f
		τ	0,7.f
		σ_e	1,8.f
Faulted	IV	σ_a	1,5.f
		σ_b	2,25.f
		τ	0,9.f
		σ_e	2,25.f

Table 43: Allowable stresses for plate and shell

14.2.4.2.2 For linear supports

According to EN 13480-3 - §13.3.6.3 - Tableau 13.3.6-1 in reference [26], the coefficients applied on the allowable stresses are the following.

Situation	**Category**	**Stresses Type**	
		Stresses Type	Allowable Stresses
Normal	I , II	σ_a	1,0.f
		σ_b	1,0.f
		τ	0,6.f
		σ_e	1,0.f
Emergency	III	σ_a	1,2.f
		σ_b	1,2.f
		τ	0,7.f
		σ_e	1,2.f
Faulted	IV	σ_a	1,5.f
		σ_b	1,5.f
		τ	0,9.f
		σ_e	1,5.f

Table 44: Allowable stresses for linear supports

Where:

- σ_a is the calculated axial stress (MPa)
- σ_b is the calculated bending stress (MPa)
- τ is the calculated shear stress (MPa)
- σ_e is the equivalent stress (MPa) defined as: $\sigma_e = \sqrt{(\sigma_a + \sigma_b)^2 + 3 \times \tau^2}$
- f is the allowable stress (MPa) defined in chapter 14.2.4.2.

14.2.5 Correlation between damage limits and service levels of ASME B31.1

For ASME B31.1 in reference [35], the service levels are considered in terms of ponderation coefficients on the different loads as follows:

14.2.5.1.1 For pipes

According to ASME B31.1 in reference [35], the coefficients applied on the allowable stresses are the following.

Coefficients applied on allowable stresses according to ASME B31.1																	
Combinations according to ASME B31.1	Type of loads										Iter load Category	Allowable stresses					Reference in ASME B31.1
	Dead weight	Design pressure	Test pressure	Thermal	Other sustained loads	Displacement		SL1	SMHV	SL2		S_h	$0.9f_a$	S_A+f(S_h-S_L)	$1.15S_h$	$1.2S_h$	
						Normal	Seismic										
1	X	X									I	X					§104.8.1
2	X				X						I	X					§104.8.1
3	X		X								I		X				§102.3.3
4				X							I			X			§104.8.3
6	X	X			X			X			II	X					§104.8.2
7	X	X			X				X		III				X		§104.8.2
8	X	X			X					X	IV					X	§104.8.2
9	X	X				X					I	X					§104.8.2
10	X	X					X				IV					X	§104.8.2

Table 45: Correlation between the damage limit the service level according to in ASME B31.1 in reference [35].

$S_L$is the sum of the longitudinal stresses due to pressure, weight, and other sustained loads
S_h is the basic material allowable stress at maximum (hot) temperature from the Allowable Stress Tables in ASME B31.1 in reference [35].
$f$is the stress range reduction factor
S_A is the allowable stress range
f_a is yield strength 0.2% ($R_p^{0.2}$) of the material to calculate the allowable stress for test loads

The ponderation coefficients k applied on the allowable stresses given in the table above are summarized in the table below for NSR – (NON-PIC), SC2 components according to ASME B31.1 in reference [35].

Seismic Class	SC2				
Safety Class	Test	Normal	Upset	Emergency	Faulted
NSR – (NON-PIC)	0.9	1	1	1.15	1.2

Table 46: Coefficients k for pipes

14.2.5.1.2 For supports

According to ASME B31.1 in reference [35] §121.2, the design of support is performed following the rules in MSS SP-58 in reference [41].

According to MSS SP-58 in reference [41] §4, the following coefficients are applied on the allowable stresses of the following stresses in the support:

N°	Type of stress		Coefficient
1	Tensile load	On the gross area	1
2		On the net section at pin holes	0.9
3	Bending		1
4	Shear		0.8
5	Bearing		1.5
6	Compression		1

Table 47: Coefficients for ASME B31.1

14.3 List of Load Combinations

Based on document in reference [05], the Load Combination and their Categorization are given as follows.

N°	Load Category	Situation	Scenario	Combinations
1		Proof / testing		$DW_{test} + P_{test}$
2	I	Operational Loading Conditions		$DW + EM + P_D + T_D + DP_t$
3	II	Likely Loading Conditions	Normal + SL1	$DW + EM + P_D + T_D + SL1 + DP_s$
4			Internal incident	$DW + P_D + T_D + EM + IINC$
5			Maintenance + SL1	$DW + T_m + SL1 + DP_s$
6			Transport	$DW + a_T + T_T$
7	III	Unlikely Loading Conditions	Normal + Internal emergency	$DW + EM + P_D + T_D + IEMR$
8			Maintenance + SMHV	$DW + T_m + SMHV + DP_s$
9			Normal+ SMHV	$DW + EM + P_D + T_D + SMHV + DP_s$
10	IV	Extremely Unlikely Loading Conditions	Normal+ SL2	$DW + EM + P_D + T_D + SL2 + DP_s$
11			Normal + Fire	$DW + EM + P_D + Fire$
12			Normal + accidents	$DW + EM + P_D + T_D + IACC$
13			Maintenance + SL2	$DW + T_m + SL2 + DP_s$

Table 48: Load Combinations

14.4 Fatigue Cycles

14.4.1 Identification of fatigue loads

The cyclic loads applying to PBS41 VS3-PS system in B13 relevant for fatigue analysis are seismic loads and thermal cycling due to pulsed power operation (max 30,000 VDE pulses, SRD-41 [18]).

The Contractor of the VS3-PS shall estimate and provide the loads from thermal cycling due to pulsed power operation when the design of the VS3-PS will be finalized. The Contractor of the VS3-PS shall declare these loads in internal load (§13.2.2) and shall provide the category (*IINC, IEMR or IACC*) of these loads according to the description given in §14.1. The Contractor of the VS3-PS shall then consider these loads in the load combinations in §14.3.

As PBS41 VS3-PS system in B13 are classified as SC2, SL1 and SL2 will be considered for fatigue analysis as follows.

14.4.2 For SL1

According to load specification in document in reference [05], five SL1 events event will occur during the lifecycle of the components.

5 events x 10 cycles/event = N=50 cycles

The fatigue analysis will be performed by accessing the maximum stress range that will cause fatigue damage after 50 cycles.

14.4.3 For SL2

According to load specification in document in reference [05], one SL2 event will occur during the lifecycle of the components.

1 events x 10 cycles/event = N=10 cycles

The fatigue analysis will be performed by accessing the maximum stress range that will cause fatigue damage after 10 cycles.