外部委託業者の募集

References: IO/25/OT/10033838/JGO

"Supply Contract for Boronization System Gas Supply System and X-Ray Core Spectroscopy Gas Supply System"

（ボロナイゼーションシステム用ガス供給システムおよび X 線コア分光システム用ガス供給システムの供給契約）

IO 締め切り 2025 年 12 月 12 日(金)

〇はじめに

本事前情報通知（PIN）は、作業契約の入札授与および実行につながる公開入札調達プロセスの最初のステップです。

この文書の目的は、作業範囲および入札プロセスに関する技術的内容の基本的な概要を提供することです。

〇背景

ITER は平和利用の核融合発電の科学的および技術的な実現可能性の実証を目的とした、国際共同研究開発プロジェクトです。ITER 機構の 7 つのメンバーは、;欧州連合（EURATOM が代表）、日本、中華人民共和国、インド、大韓民国、ロシア連邦、および米国です。

ITER の敷地はフランス南東部のブーシュデュローヌ地区にあり、ITER 本社（HQ）もあるフランス CEA サン・ポール・レ・デュランス に近いところに位置しています。詳細については、ITER のウェブサイト http://www.iter.org を参照して下さい。

〇作業範囲

現在の入札プロセスは、ITERのボロナイゼーションシステム用ガス供給システムおよびX線コア分光システム用ガス供給システムの実装に関する供給契約を締結することを目的としています。

作業範囲には、ボロナイゼーションシステム用ガス供給システムおよびX線コア分光システム用ガス供給システムの設計、製造、納入後の設置支援が含まれます。

詳細については、付属書Ⅱ「技術仕様書 ECGNC8_v1_4」を参照してください。なお、ガスキャビン設計（第6.5条）および設置・建設（第8条）の範囲は、今回の入札には含まれません。技術仕様書の最終版は、入札パッケージとともに発行されます。

〇調達プロセスと目的

目的は、競争入札プロセスを通じて供給契約を落札することです。

この入札のために選択された調達手続きは**公開入札**手続きと呼ばれます。

オープン入札手順は、次の 4 つの主要なステップで構成されています。

- ステップ 1-事前情報通知（PIN）

  事前情報通知は公開入札プロセスの第一段階です。IO は、関心のある候補企業に対し、以下の概略日程に示された期日までに担当調達担当官に添付の関心表明フォームで以下の情報を提出し、競争プロセスへの関心を示すよう正式に要請します。

  特に注意:

  関心のある候補企業は、IO Ariba の電子調達ツール 「IPROC」 に登録してください（まだ登録していない場合）。手順については、
  https://www.iter.org/fr/proc/overview
  を参照してください。

  Ariba (IPROC) に登録する際には、お取引先様に最低 1 名の担当者の登録をお願いします。この連絡担当者は、提案依頼書の発行通知を受け取り、必要と思われる場合は入札書類を同僚に転送することができます。

- ステップ 2-入札への招待

  関心表明提出後、提案依頼書（RFP）を 「IPROC」 に掲載します。この段階では、担当の調達担当者に関心を示し、かつ IPROC に登録している関心のある候補企業は、RFP が公表された旨の通知を受けることができます。その後、RFP に詳述されている入札説明書に従って提案書を作成し、提出します。

  このツールに登録されている企業のみが入札に招待されます。

- ステップ 3-入札評価プロセス

  入札者の提案は、IO の公平な評価委員会によって評価されます。入札者は、技術的範囲に沿って、かつ、RFP に記載された特定の基準に従って作業を実施するために、技術的遵守を証明する詳細を提供しなければなりません。

- ステップ 4-落札

  認定は、公開されている RFP に記載されている、コストに見合った最適な価格または技術的に準拠した最低価格に基づいて行われます。

〇概略日程

概略日程は以下の通りです：

マイルストーン	暫定日程
事前指示書（PIN）の発行	2025 年 11 月 28 日
関心表明フォームの提出	2025 年 12 月 12 日
入札開始	2025 年 12 月 19 日

明確化のための質問（もしあれば）と回答	入札提出の 5 日前
入札提出	2026 年 1 月 30 日
入札評価と契約授与	2026 年 2 月
契約調印	2026 年 2 月

〇契約期間と実行

ITER機構は2026年の2月に供給契約を授与する予定です。予想される契約期間は60か月の予定です。

〇候補

参加は、個人またはグループ/コンソーシアムに参加するすべての法人に開放されます。法人とは、法的権利及び義務を有し、ITER 加盟国内に設立された個人、企業又は機構をいいます。ITER 加盟国は欧州連合(EURATOM メンバー)、日本、中華人民共和国、インド共和国、大韓民国、ロシア連邦、アメリカ合衆国です。

法人は、単独で、またはコンソーシアムパートナーとして、同じ契約の複数の申請または入札に参加することはできません。共同事業体は、恒久的な、法的に確立されたグループ又は特定の入札手続のために非公式に構成されたグループとすることができます。

コンソーシアムのすべての構成員(すなわち、リーダーと他のすべてのメンバー)は、ITER 機構に対して連帯して責任を負います。

コンソーシアムとして許可されるために、その点で含まれる法人はコンソーシアムの各メンバーをまとめる権限をもつリーダーをもたなければなりません。このリーダーはコンソーシアムの各目メンバーのために責任を負わなければなりません。

指名されたコンソーシアムのリーダーは、入札段階で、コンソーシアムのメンバーの構成を説明する予定です。その後、候補者の構成は、いかなる変更も ITER 機構に通知することなく変更してはなりません。かかる認可の証拠は、すべてのコンソーシアムメンバーの法的に授権された署名者が署名した委任状の形式で、しかるべき時期に IO に提出しなければなりません。

どのコンソーシアムメンバーも IPROC に登録する必要があります。

【※　詳しくは添付の英語版技術仕様書「 **Supply Contract Boronization System Gas Supply System and X-Ray Core Spectroscopy Gas Supply System**」をご参照ください。**】**

ITER 公式ウェブ　http://www.iter.org/org/team/adm/proc/overview からもアクセスが可能です。

「核融合エネルギー研究開発部門」の HP：　http://www.fusion.qst.go.jp/ITER/index.html
では ITER 機構からの各募集（IO 職員募集、IO 外部委託、IO エキスパート募集）を逐次更新しています。ぜひご確認ください。

イーター国際核融合エネルギー機構からの外部委託に関心ある企業及び研究機関の募集について

＜ITER 機構から参加極へのレター＞

以下に、外部委託の概要と要求事項が示されています。参加極には、提案された業務に要求される能力を有し、入札すべきと考える企業及び研究機関の連絡先の情報を ITER 機構へ伝えることが求められています。このため、本研究・業務に関心を持たれる企業及び研究機関におかれましては、応募書類の提出要領にしたがって連絡先情報をご提出下さい。

PRIOR INFORMATION NOTICE (PIN)

OPEN TENDER SUMMARY

IO/25/OT/10033838/JGO

for

Supply Contract
Boronization System Gas Supply System and X-Ray Core Spectroscopy Gas Supply System

Prior Indicative Notice annexes:
- Annex I: Expression of Interest Form
- Annex II: Technical Specification ECGNC8_v1_4

IO Contact Persons: Jingyu.Gao@iter.org and Serena.Profita@iter.org

Abstract

The purpose of this summary is to provide prior notification of the IO's intention to launch a competitive Open Tender process in the coming weeks. This summary provides some basic information about the ITER Organisation, the technical scope for this tender, and details of the tender process.

1 Introduction

This Prior Information Notice (PIN) is the first step of an Open Tender Procurement Process leading to the award and execution of Supply Contract.

The purpose of this document is to provide a basic summary of the technical content in terms of the scope of work, and the tendering process.

2 Background

The ITER project is an international research and development project jointly funded by its seven Members being, the European Union (represented by EURATOM), Japan, the People's Republic of China, India, the Republic of Korea, the Russian Federation and the USA. ITER is being constructed in Europe at St. Paul–Lez-Durance in southern France, which is also the location of the headquarters (HQ) of the ITER Organization (IO).

For a complete description of the ITER Project, covering both organizational and technical aspects of the Project, visit www.iter.org.

3 Scope of Work

The present tender process is aiming to set up a Supply Contract for the implementation of the ITER Boronization System Gas Supply System and X-Ray Core Spectroscopy Gas Supply System.

The scope of work includes the design, manufacture and installation support post delivery of the Boronization System Gas Supply System and X-Ray Core Spectroscopy Gas Supply System.

For more details, please refer to Annex II: Technical Specification ECGNC8_v1_4. Please note that the scope of gas cabin design (as per article 6.5) and installation and construction (as per article 8) is excluded from the present tender. The definitive version of the Technical Specifications will be issued with the tender package.

4 Procurement Process & Objective

The objective is to award one Supply Contract through a competitive bidding process.
The Procurement Procedure selected for this tender is called the Open Tender procedure.
The Open Tender procedure is comprised of the following four main steps:

- Step 1- Prior Information Notice (PIN)
  The Prior Information Notice is the first stage of the Open Tender process. The IO formally invites interested Suppliers to indicate their interest in the competitive process by returning to the Procurement officer in charge the attached "Expression of Interest and PIN Acknowledgement" (Annex I) by the date indicated under the procurement timetable.
  Special attention:
  Interested tenderers are kindly requested to register in the IO Ariba e-procurement tool called "IPROC". You can find all links to proceed along with instruction going to: https://www.iter.org/fr/proc/overview.
  When registering in Ariba (IPROC), suppliers are kindly requested to nominate at least one contact person. This contact person will be receiving the notification of publication of the Request for Proposal and will then be able to forward the tender documents to colleagues if deemed necessary.

- Step 2 - Invitation to Tender

The Request for Proposals (RFP) will be published on our digital tool "Iproc" after the submission of Expression of Interest. This stage allows interested bidders who have indicated their interest to the Procurement Officers in charge AND who have registered in IPROC to receive the notification that the RFP is published. They will then prepare and submit their proposals in accordance with the tender instructions detailed in the RFP.

Only companies registered in this tool will be invited to the tender.

- Step 3 – Tender Evaluation Process
  Tenderers proposals will be evaluated by an impartial evaluation committee of the IO. Tenderers must provide details demonstrating their technical compliance to perform the work in line with the technical scope and in accordance with the particular criteria listed in the RFP.

- Step 4 – Contract Award
  One Supply Contract will be awarded on the basis of best value for money or lowest priced technically compliant method, according to the evaluation criteria and methodology described in the RFP.

Procurement Timetable

The tentative timetable is as follows:

Milestone	Date
Publication of the Prior Indicative Notice (PIN)	28 November 2025
Submission of Expression of Interest form	No later than 12 December 2025
Tender launch	No later than 19 December 2025
Clarification Questions (if any) and Answers	5 days before submission deadline
Tender Submission	30 January 2026
Tender Evaluation & Contract Award	February 2026
Contract Signature	February 2026

5 Quality Assurance Requirements

Prior to commencement of any work under this Contract, a "Quality Plan" shall be produced by the Supplier and Subcontractors and submitted to the IO for approval, describing how they will implement the ITER Procurement Quality Requirements.

6 Contract Duration and Execution

The ITER Organization is planning to award the Supply Contract in February 2026. The estimated contract duration should be 60 months.

7 Candidature

Participation is open to all legal entities participating either individually or in a grouping/consortium. A legal entity is an individual, company, or organization that has legal rights and obligations and is established within an ITER Member State, being, the European Union (represented by EURATOM), Japan, the People's Republic of China, India, the Republic of Korea, the Russian Federation and the USA.
Legal entities cannot participate individually or as a consortium partner in more than one application or tender of the same contract. A consortium may be a permanent, legally established grouping, or a grouping which has been constituted informally for a specific tender procedure. All members of a consortium (i.e. the leader and all other members) are jointly and severally liable to the ITER Organization.

In order for a consortium to be acceptable, the individual legal entities included therein shall have nominated a leader with authority to bind each member of the consortium, and this leader shall be authorised to incur liabilities and receive instructions for and on behalf of each member of the consortium.
It is expected that the designated consortium leader will explain the composition of the consortium members in its offer. Following this, the Candidate’s composition must not be modified without notifying the ITER Organization of any changes. Evidence of any such authorisation shall be submitted to the IO in due course in the form of a power of attorney signed by legally authorised signatories of all the consortium members.
Any consortium member shall be registered in IPROC.

8 Sub-contracting Rules

All sub-contractors who will be taken on by the Contractor shall be declared with the tender submission in IPROC. Each sub-contractor will be required to complete and sign forms including technical and administrative information which shall be submitted to the IO by the tenderer as part of its tender.
All declared sub-contractors must be established within an ITER Member State in order to participate.
The IO reserves the right to approve (or disapprove) any sub-contractor which was not notified in the tender and request a copy of the sub-contracting agreement between the tenderer and its subcontractor(s). Rules on sub-contracting are indicated in the RFP itself.

ANNEX I

EXPRESSION OF INTEREST & PIN ACKNOWLEDGEMENT

To be returned by e-mail to: Jingyu.Gao@iter.org with Serena.Profita@iter.org and in cc

Tender reference: **IO/25/OT/10033838/JGO**

Description: **Supply Contract for Boronization System Gas Supply System and X-Ray Core Spectroscopy Gas Supply System**

Procurement Officer: **Jingyu Gao**

Company Name: ....

Country of Origin: ....

☐ WE ACKNOWLEDGE HAVING READ THE PIN NOTICE FOR THE ABOVE MENTIONED TENDER

☐ WE INTEND TO SUBMIT A TENDER

☐ WE ARE ALREADY REGISTERED IN IPROC

☐ WE INTEND TO REGISTER IN IPROC

Please list the users of ARIBA/IPROC that you wish to add as response team for this tender:

Name	E-mail
…	…

……...…………

Signature:

COMPANY STAMP

Name: ....

Position: ....

Tel: ....

E-mail...

Date: ....

IDM UID
ECGNC8

VERSION CREATED ON / VERSION / STATUS
16 Oct 2025 / 1.4 / Approved

EXTERNAL REFERENCE / VERSION

Technical Specifications (In-Cash Procurement)

Technical Specification of the Boronization system gas supply system and XRCS Gas supply system

Technical Specification of the Boronization system gas supply system and XRCS Gas supply system. The scope includes Design, Gate Review implementation, Manufacture, delivery and optional installation

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NOTE: This version includes tracked changes per review comments (RO mandatory reviewer, PL approver, clarifications on spare parts, materials, QA procedure 22MFG4, date corrections, and standards editions). All edits are visible for acceptance.

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1 Preamble

This Technical Specification is to be read in combination with the General Management Specification for Service and Supply (GM3S) – Ref [1] that constitutes a full part of the technical requirements.

In case of conflict, the content of the Technical Specification supersedes the content of Ref [1].

2 Purpose

The purpose of this Technical Specification document to define the scope, responsibilities and requirements relevant to the implementation of the ITER Boronization system and XRCS gas supply system.

The change of the ITER machine with a first wall armour from beryllium to tungsten triggered the need for boronization which aims at coating the surfaces with boron species by injecting a mixture of diborane gas with helium from numerous locations in the ITER Vacuum Vessel and performing a thin film deposition via glow discharge.

The XRCS system on the ITER machine requires the supply of Xenon gas from a single location. This Xenon gas supply system is much smaller in scope than the Boronization system.

This document contains the technical specification for the design and analyses of the systems, and for the manufacturing and optional installation of the ex-vessel components.

3 Acronyms & Definitions

3.1 Acronyms

The following acronyms are the main one relevant to this document.

Abbreviation	Description
BGVB	Boronization Gas Valve Box
BoM	Bill of Material
CDR	Conceptual Design Review
CRO	Contract Responsible Officer
DIR	Design Integration Review
EP	Embedded Plate
EWP	Engineering Work Package
FDR	Final Design Review
GM3S	General Management Specification for Service and Supply
HP	Hold Point
ICD	Interface Control Document
IDM	ITER Document Management system
IO	ITER Organization

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IS	Interface Sheet
MIP	Manufacturing Inspection Plan
MRR	Manufacturing Readiness Review
MTO	Material Take Off
PDR	Preliminary Design Review
PED	Pressure Equipment Directive
PFP	Passive Fire Protection
PIA	Protection Important Activity
PIC	Protection Important Component
PRO	Procurement Responsible Officer
RH	Remote Handling
SIC	Safety Important Component
PIC	Protection Important Component
XRCS	X-Ray Core Spectroscopy

ITER Abbreviations (2MU6W5)

3.2 Definitions

The following definitions are the main one relevant to this document.

Word	Description
CBT tool	The validation of the EP capacity is performed using the Calculation Book Tool (CBT). The validation is performed by using CBT Excel spreadsheets (see Calculation Book Tool Validation - Standard and Special Embedded Plates Interaction Diagram Check - ENG_04_QQ_0D0012_CW (4HMAAT) and attached files)
Common Support	A common support is a new metallic structure replacing several existing single supports from various PBS
Contractor	shall mean an economic operator who have signed the Contract in which this document is referenced
May	not a requirement or constraint, included as a suggestion or recommendation to the implementing contractor
Shall	mandatory requirement or rigid constraint
Shared Support	A metallic supporting structure with attachment of another PBS's components
Should	optional requirement or flexible constraint

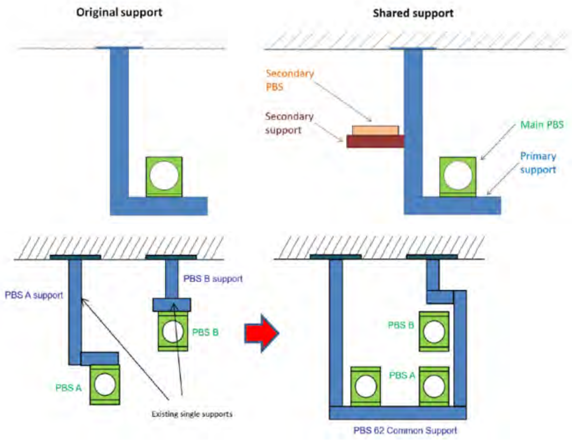

Image 1 Shared Support Common support definition

4 Applicable Documents & Codes and standards

4.1 Diagram

The SRDs and PIDs shall be consistent with the design and shall be implemented by IO [5] [6]. Examples are referenced in this document.

4.2 Applicable Documents

This is the responsibility of the Contractor to identify and request for any documents that would not have been transmitted by IO, including the below list of reference documents.

This Technical Specification takes precedence over the referenced documents. In case of conflicting information, this is the responsibility of the Contractor to seek clarification from IO.

Upon notification of any revision of the applicable document transmitted officially to the Contractor, the Contractor shall advise within 4 weeks of any impact on the execution of the contract. Without any response after this period, no impact will be considered.

Ref	Title	IDM Doc ID	Version
1	General Management Specification for Service and Supply (GM3S)	82MXQK	1.4
2	Boronization SRD	AQPUC7	1.0
3	Boronization Defined Requirements	ADKKPM	1.1
4	List of ICDs	AM634V	1.0
5	CDR level - PFD	DJGN6T	1.0
6	CDR level - P&ID	9BJL49	1.1
7	Boronization SDD	DEWYGP	1.0
8	In vessel Load Specification	CH78LX	1.2
9	Ex vessel Load Specification	CQ5VB8	1.0

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10	3D models references	Supplied separately by IO	
11	PCR-001624 - Baseline 2024 - Scenario B - Addition of the Boronization system (daughter of PCR-001600)	PCR-001624	
12	HAZOP Level 1	5CHF47	1.0
13	Mass balance and sizing calculation	9BKB8Z	1.0
14	IC/STAC-Overview Boronization system	9EGV4Y	1.1
15	Technical Uncertainties Register	9BJPSV	1.1
16	CDR Input data package	AF9DSX	1.1
17	Pilot piping stress analyses	DUPTR4	1.0
18	Design Review Procedure	2832CF	7.0
19	ITER System Design Process (SDP) Working Instruction	4CK4MT	4.1
20	Template for SDR Input Data Package	TWW7AY	4.1
21	Diagram - Electrical (single line diagram) of ITER GIS	3CQZDC	1.9
22	Description Document of ITER GIS I&C (including Functional Analysis, Machine State, Cubicles, Conventional, Interlock, and Safety)	3CR48X	1.7
23	I&C Signal List of ITER GIS	3Z3XJ4	2.1
24	I&C Data List of ITER GIS	3Z44FP	2.2
25	EWP Toolbox	EWP Toolbox link	
26	CBT tool	4HMAAT	3.0
27	ITER Vacuum Handbook	2EZ9UM	2.5
28	Décret n° 2015-799 du 1er juillet 2015 relatif aux produits et équipements à risques - EN (U5TKD4)	U5TKD4	1.0
29	EDH Part 1: Introduction (2F7HD2)	2F7HD2	1.4
30	Plant Control Design Handbook (27LH2V)	27LH2V	7.1
31	Instructions for Structural Analyses	35BVV3	4.1
32	Instructions for Seismic Analyses	VT29D6	2.0
33	Classifications of the Boronization system	DPNHKQ	1.0
34	Input – Preliminary supports list	Supplied separately by IO	
35	Input – Preliminary embedded plate list	Supplied separately by IO	
36	Input – Preliminary models	Supplied separately by IO	
37	Input – floor response spectra	Supplied separately by	

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		IO	
38	Input – preliminary analyses – geometry, 3D models, BoM Template	Supplied separately by IO	
39	Chemical composition and impurity requirements for materials	REYV5V	3.0
40	Order dated 7 February 2012 relating to the general technical regulations applicable to INB.	7M2YKF	1.7
41	List of ITER-INB Protections Important Activities	PSTTZL	2.2
42	Working Instruction for Manufacturing Readiness Review (44SZYP)	44SZYP	5.1
43	Procedure for management of Nonconformities	22F53X	8.2
44	Procedure for the management of Deviation Request	2LZJHB	7.3
45	Procedure for Labelling on Physical Items	VYJ7U2	1.3
46	Working Instruction for the Delivery Readiness Review	X3NEGB	3.1
47	Release Note Template	QVEKNQ	3.1
48	Delivery Report Template	WZPYVZ	3.1
49	Package & Packing List Template	XBZLNG	1.1
50	ATEX risk assessment of PBS18.BG	E4TEBX	1.1
51	CAD Supplier Package	5HHVT9	
52	CAD Manual	29FVC2	
53	Shared Supports Management Working Instruction	XQK5MR	4.1
54	ITER RAMI Analysis Programme	28WBXD	4.6
55	Check list for TDFC Manufacturing Drawing produced at IO	7MXHTR	3.0
56	CATIA BOM Macro enhancements	XB8F7G	5.1
57	Independent Peer Review Checklist	VQVFEN	1.0
58	Technical Checker Checklist for Structural Analysis	TK33SU	2.0
59	Safety Analysis for Explosion from Diborane Cabinet	APNQJK	2.0
60	Template for Construction Support Tagged Item Lis	2CSXHN	3.1
61	Quality Requirements for IO Performers	22MFG4	6.3

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4.3 Applicable Codes and Standards

This is the responsibility of the Contractor to procure the relevant Codes and Standards applicable to that scope of work.

Ref	Title	Doc Ref.	Version
	Ex-vessel piping design ASME B31.3 M 2020		
	In-vessel piping design RCC-MR 2007		
	Supports design EUROCODE STANDARD EN1993 Eurocode 3 en Eurocode 8		
	Pipe bending PFI Standard ES-24 (Reaffirmed - September 2010) PIPE BENDING METHODS, TOLERANCES, PROCESS AND MATERIAL REQUIREMENTS		

5 System Overview

Boronization Process Description The boronization process consists of forming a thin amorphous layer of boron species on plasma-facing surfaces by injecting a mixture of diborane gas with helium and performing a glow discharge process. As the boron layer is removed by plasma operation, periodic recoating is required. At ITER it is envisaged to perform boronization st a maximum frequency of every two weeks. To introduce this new Boronization function at ITER, a process and mechanical design has been prepared including modelling, option studies, development of operating steps, control schemes, sizing calculations and routing/layout studies. A number of changes are required to perform the boronization process.

The major changes are listed below:

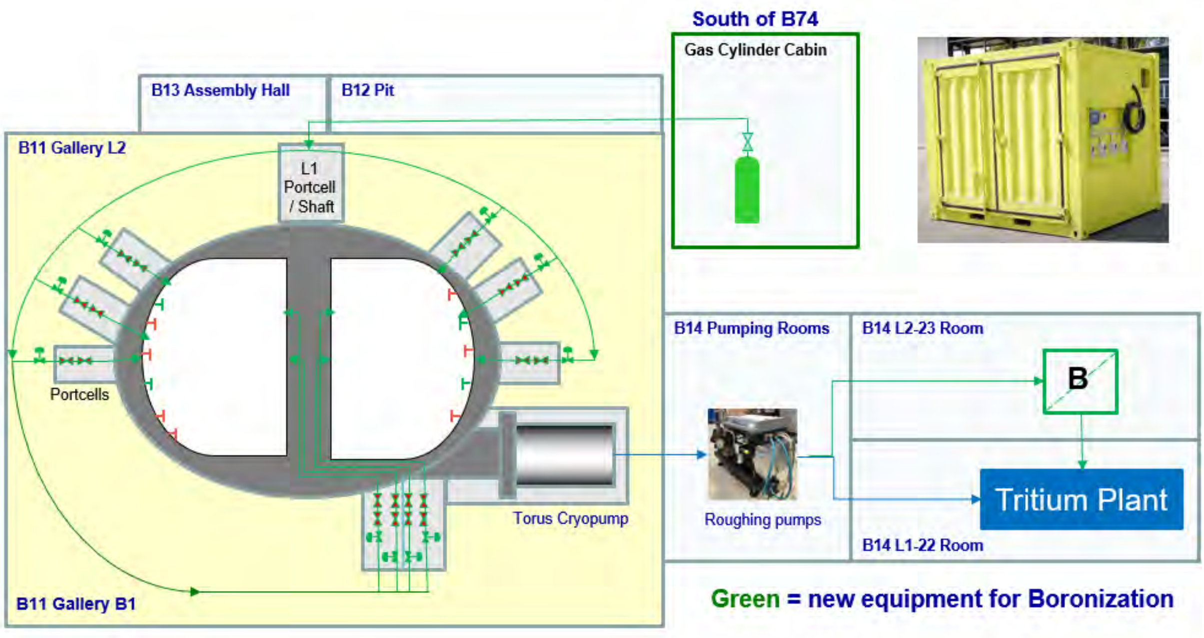
• Installation of new Glow Discharge Cleaning electrodes to four ports with associated services (cabling, power supply cubicles and cooling water) [11]*(out of scope of this document)*

• Installation of 21 new gas injection lines (including in vessel distribution lines) with safety isolation valves, gas valve boxes, control equipment and supply manifolds with building wall penetrations *(Within the scope of this document)*

• Installation of a new gas cabin to house the supply cylinder of diborane *(Within the scope of this document)*

• Introduction of a new diborane destruction unit *(out of scope of this document)*

Technical overview of system is available in STAC report[14]. Technical uncertainties are recorded [15].



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5.1 System component classifications

From [33].

5.1.1 Boronization Gas Cabin

Boronization Gas Cabin

	Quality class	Safety class	Seismic class	Vacuum class	PED class	ESPN	Tritium class
Diborane confining components within Gas Cabin	QC-1	SR	SC1 (S)	N/A	No Category	No Category	N/A
Gas Cabin itself	QC-2	SR	SC1(S)	N/A	No Category	No Category	N/A

5.1.2 Boronization Piping Network

The Boronization Gas Supply Network provides Diborane in a carrier gas of Helium at subatmospheric pressure.

BG Piping Network

	Quality class	Safety class	Seismic class	Vacuum class	PED class	ESPN	Tritium class
Internal pipe	QC-1	PIC-SIC 2	SC1(S)	N/A	PED N/A	N/A	N/A
External pipe	QC-2	PIC-SIC 2	SC1(S)	N/A	PED N/A	N/A	N/A
Supports	QC-2	PIC-SIC 2	SC1(S)	N/A	PED N/A	N/A	N/A
Penetration to enter Tokamak Complex	QC-1	PIC-SIC 1HCC	SC1(S)	N/A	PED N/A	N/A	N/A

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5.1.3 Boronization Gas Valve Boxes and Vacuum Extensions

]

	Quality class	Safety class	Seismic class	Vacuum class	PED class	ESPN	Tritium class
BGVB External Barrier	QC-2	PIC/ SIC-2	SC1(S)	VQC-N/A	PED N/A	N/A	N/A
BGVB Internal gas confining components	QC-2	PIC/ SIC-2	SC1(S)	VQC-N/A	PED N/A	N/A	TC-1A
Vacuum extension	QC-1	PIC/ SIC-1	SC1(S)	VQC-1A	PED N/A	N/A	TC-1A

Boronization Gas Valve Boxes and Vacuum Extensions

5.2 Contract Gates

In addition to the contract gates specified in ref [1], A contract gate shall exist for design implementation formailising the CAD strategy, 2D drawing format and analysis strategy.

6 Scope of Work – Design

More than a kilometre of gas injection lines will be required for the boronization system. Above, the preliminary design of the proposed route through the lower level of the tokamak building with the gas lines in orange.

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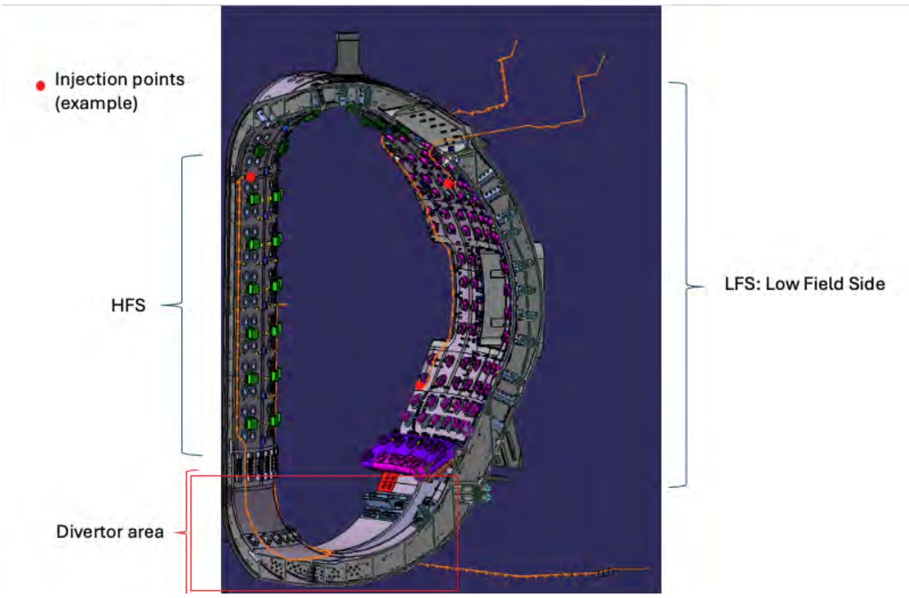
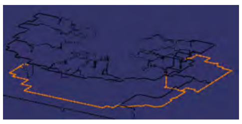


21 gas injection points will be added to the inside of the tokamak for the boronization system.

This section defines the design scope of work and its requirements, in addition to the contract execution requirement as defined in Ref [1].

No.	Design package	Length (metres)	Pipe Information	Support information	Task
1	Gas cabin to B11 	~106	DN08 Sch10s in DN32 Sch10s	Post drilled,~2-3m span	Produced detailed model in CATIA E&S workbench suitable for promotion according to ITER Design rules to allow PCF file production and Manufacturing Readiness Review
2	B11 gallery B1 	~180	DN08 Sch10s in DN32 Sch10s	Post drilled, Shared supports &EPs ~2-3m span	Produced detailed model in CATIA E&S workbench suitable for promotion according to ITER Design rules to allow PCF file production and Manufacturing Readiness Review
3	B11 gallery L1 	~66	DN08 Sch10s in DN32 Sch10s	Post drilled, Shared supports &EPs ~2-3m span	Produced detailed model in CATIA E&S workbench suitable for promotion according to ITER Design rules to allow PCF file production

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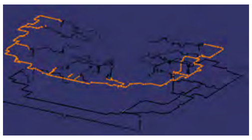
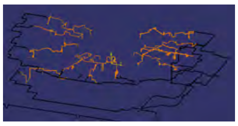
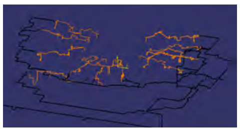
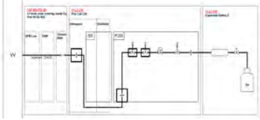
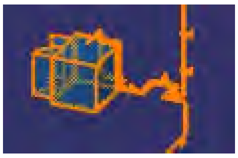
					and Manufacturing Readiness Review
4	B11 gallery L2 	~235	DN08 Sch10s in DN32 Sch10s	Post drilled, Shared supports &EPs ~2-3m span	Produced detailed model in CATIA E&S workbench suitable for promotion according to ITER Design rules to allow PCF file production and Manufacturing Readiness Review
5	B1 PC 	~222	DN08 Sch10s in DN32 Sch10s	Post drilled, Shared supports &EPs ~2-3m span	Produced detailed model in CATIA E&S workbench suitable for promotion according to ITER Design rules to allow PCF file production and Manufacturing Readiness Review
4	L2 PC 	~188	DN08 Sch10s in DN32 Sch10s	Post drilled, Shared supports &EPs ~2-3m span	Produced detailed model in CATIA E&S workbench suitable for promotion according to ITER Design rules to allow PCF file production and Manufacturing Readiness Review
5	In-vessel 	~377	DN08 Sch10s	Supports every ~1-1.5m	Design is now completed and approved. Manufacture of supports is required to be implemented by supplier.
6	Xenon XRCS gas supply system 	~30 metres	TBC	Supports every ~1-1.5m	Produced detailed model in CATIA E&S workbench suitable for promotion according to ITER Design rules to allow PCF file production and Manufacturing Readiness Review
7	Gas cabin	N/A	N/A	N/A	Gas cabin information in will be provided to Supplier by IO. Supplier shall

SUPPLY

					Integrate, procure and deliver to IO with optional installation. Exhaust stack of Gas Cabin shall be 5m tall and attached to roof of cabin.

MRR shall occur according to ref [42]

The Scope shall best estimated in cost by supplier with a rework cost per metre in the event of later change due to integration re-routing. The rework cost per metre shall include design and analysis update. The rework costs can different values; for example, type 1 significant change require design and pipe stress analysis update, type 2 simple change requiring only minor pipe stress analysis update, Type 3 is support design and support calculation update only etc

6.1 Scope overview and requirements

6.1.1 Overview

The scope is to provide the detailed design and analyses for the boronization system. It starts by using the conceptual design data and the system requirements (input data provided by the IO) and ends with the completion of the final design phase and the closure of all the chits.

A general description of the boronization system is provided in [16].

It is planned to not have a PDR and the design shall be brought to a FDR level directly. A combined PDR/FDR is hence foreseen with a design and deliverables meeting the FDR requirements.

The detailed design scope is as follows:

A. Develop detailed and complete design and analyses for the boronization and XRCS Xenon gas supply system
   - Perform the engineering design
   - Perform needed analyses for the ex-vessel pipe network piping structural analyses, thermal analyses, and piping support structural analyses
   - Demonstrate consistency of the design with all its technical interfaces[4]
B. Develop 3D CM and DM models
   - Develop the models to represent the complete design
   - Resolve integration, clash issues during design development
   - Demonstrate consistency of the models against the P&ID
   - Finalize the models post FDR (as needed) to close any remaining design issues
C. Support preparation of the DIR and resolutions of the post meeting actions
D. Resolve and close all the CDR chits (together with IO)
E. Prepare and develop all the required deliverables for the FDR (see Appendix 3)
F. Prepare and organize the FDR meeting
G. Resolve and close all the FDR chits (together with IO)
H. Prepare and develop all the required deliverables, BoM, drawings, installation technical specifications for the EWP
I. Develop the schedule of activities needed to execute the scope of work

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6.1.2 Design requirements

6.1.2.1 General

The requirements to be met by the System are defined in the SRD [2]. The SRD is complemented by a series of specific applicable documents which contain detailed requirements to be met during the design of the system such as:

- Management of CAD Work and CAD Data [51] [52] [56]
- In-vessel and Ex-vessel Load Specifications [8,9]
- Electrical Design Handbook [29]
- Vacuum Design Handbook [27]
- Plant Control Design Handbook [30]
- Quality Requirements for IO Performers [61]

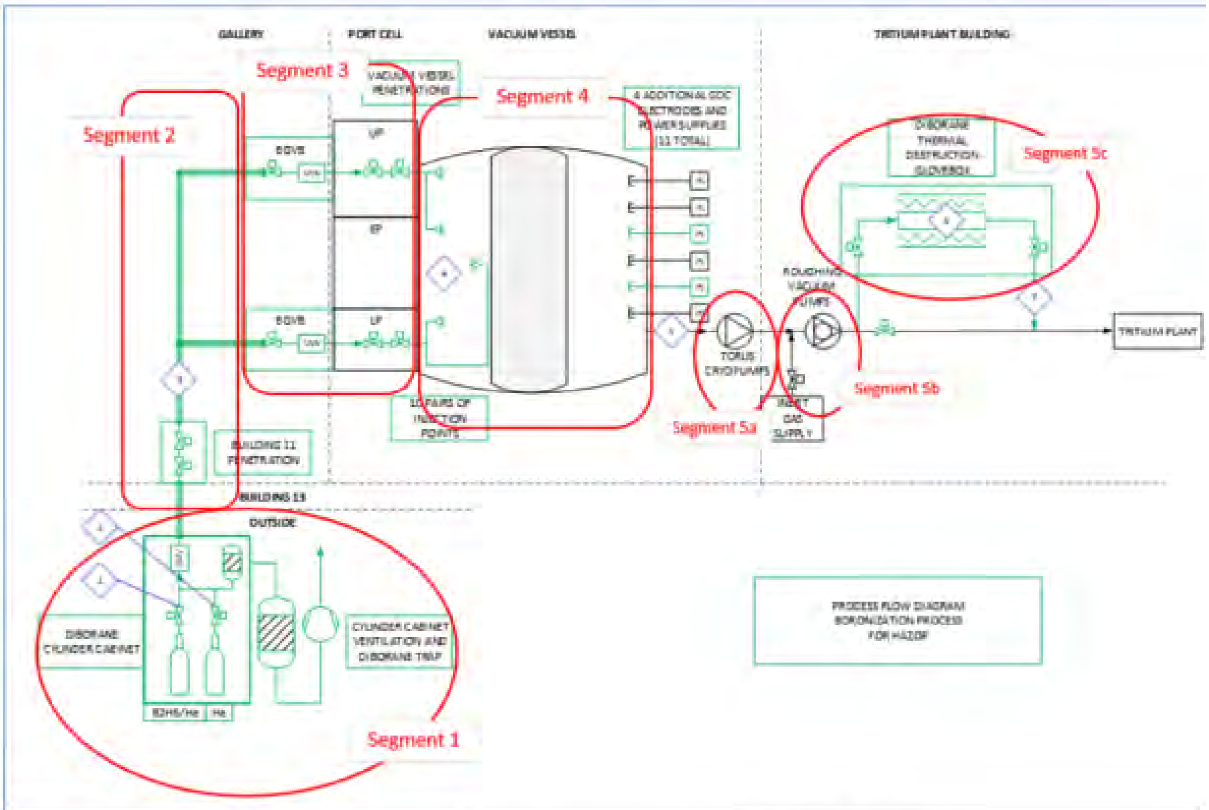
6.1.2.2 Licencing

The French Order [40] concerning Basic Nuclear Installation design, construction and operation is applicable to the PIC components of the Boronization system.

6.1.3 *Safety Requirements*

The design shall be compatible with the listed required in list of defined requirements for the boronization system [3]

The responsibility of propagating and implementing the requirements is described after each one. The Identifiers [IO] and [Supplier] are used to indicated whether the responsibility is a joint responsibility of both the IO and Supplier simply a responsibility of the IO.



Segment	Design intent
Segment 1	Cabin and Gas cabinet
Segment 2	Gas line supply
Segment 3	Port Cells
Segment 4	Injection system
Sub-segment 5.a	VV pumpimg
Sub-segment 5.b	Pumpimg system
Sub-segment 5.c	Thermal treatment

Sub segments 5a,5b and 5c in the image above are out of scope of this document.

Segment 1 – Cylinder cabined / outdoor area

Generic:

[RQ-1] [DRQ] Cooling of cabin with alarm control shall be implemented in order to avoid diborane decomposition. [IO]

[RQ-2] [DRQ] Forced ventilation of the cabin shall be implemented, discharging to atmosphere via a diborane chemical trap. [IO] [Supplier]

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[RQ-3] [DRQ] Diborane detection shall be implemented in the cabin and gas cabinet. [IO] [Supplier]

[RQ-4] [DRQ] The current safety assessment is based on the assumption that the cylinder of diborane will be fully emptied without site storage. If it is expected to keep a full cylinder on site, the current safety assessment shall be updated to demonstrate that there is no additional safety risk. [IO]

Fire:

[RQ-5] [DRQ] The cabin shall be fire resistant with fire rating walls of 2 h. [IO] [Supplier]

[RQ-6] [DRQ] The fire loads inside the cabin shall be limited. [IO] [Supplier]

[RQ-7] [DRQ] The installation shall be equipped with fire-fighting means appropriate to the risks and in accordance with the standards in force. [IO]

Explosion:

[RQ-8] [DRQ] The risk of diborane cylinder explosion may be due to diborane decomposition. To avoid this risk, the molar concentration of diborane in the cylinder shall be limited to 10%. [IO] [Supplier]

[RQ-9] [DRQ] All equipment of cabin shall be ATEX rated. [IO] [Supplier]

[RQ-10] [DRQ] In case of explosion inside the cabin the overpressure wave must be acceptable for buildings and PICs in the vicinity (less than 50 mbar). The current identified targets are B74, B75, B13, B11, B44, B46 and area 53 (cryogenic tanks). [IO]

[RQ-11] [DRQ] If required by overpressure wave study, a blast wall shall be implemented. [IO]

[RQ-12] [DRQ] Periodic inspections of the cabin shall be carried out. [IO]

External hazards

[RQ-13] [DRQ] Missile effects, external fire effects, external flooding and external explosion effects from other buildings to cabin shall be assessed [IO]

[RQ-14] [DRQ] Impact of seismic event on the cabin shall be assessed. The seismic design of the cabin and its equipment shall be such that acceptable impact on nearby buildings and PICs can be demonstrated. [IO] [Supplier]

[RQ-15] [DRQ] The route of the truck carrying diborane cylinder must be assessed to avoid as much as possible crossing sensitive IO buildings. Transport route of bottle up to cabin location shall take into account potential impact on PIC targets, for example due to explosion of bottle. [IO]

[RQ-16] [DRQ] Safety bollards shall be put around the cabin to avoid vehicle collisions. [IO]

Occupational health and safety:

[RQ-17] The respiratory protection equipment Self Contained Breathing Apparatus must be used during cylinder change operations. [IO]

[RQ-18] A restriction area around the cabin must be defined and applied for diborane cylinder change operation. [IO]

[RQ-19] When entering inside the cabin, operators must wear portative diborane detectors. [IO]

[RQ-20] The risk of anoxia inside the cabin shall be assessed due to a potential default of nitrogen or helium equipment. [IO]

[RQ-21] Operators making cylinder changes shall be trained to ensure they will follow all the safety requirements and also to avoid as much as possible human errors during cylinder handling and connections [IO]

Segment 2 – Diborane distribution in gallery

Global/explosion:

[RQ-22] [DRQ] Provisions shall be taken to limit flow rate flowing from the gas storage area in order to minimize the flammability and explosion risk in the gallery. [IO]

[RQ-23] [DRQ] Double-containment (lines and components connected to such lines) shall be required for diborane distribution in gallery. [IO] [Supplier]

[RQ-24] [DRQ] Monitoring of the interspace of double-contained piping and equipment located in gallery shall be provided. [IO]

[RQ-25] [DRQ] Provisions shall be taken to minimize impact of co-activities performed in the gallery during the boronization process. [IO]

Penetrations:

[RQ-26] [DRQ] Last confinement isolation shall be provided for penetration of piping crossing the external wall of the tokamak complex. [IO] [Supplier]

[RQ-27] [DRQ] The penetration of the boronization system from gallery to port cell shall reconstitute the barrier properties [PR1198]. [IO]

[RQ-28] [DRQ] The piping connected to the vacuum vessel shall be equipped with redundant isolation devices. [IO] [Supplier]

Segment 3 – Diborane distribution in port cell

Global:

[RQ-29] [DRQ] Provisions shall be taken to limit flow rate flowing from the gas storage area in order to minimize the flammability and explosion risk in the port cell. [IO]

[RQ-30] [DRQ] Access to port cell during boronization operation shall be forbidden. [IO]

Explosion:

[RQ-31] [DRQ] Double-containment (lines and components connected to such lines) is recommended. In case of not having double-containment, provisions to limit inventory in case of pipe failure/leak (detection/isolation) shall be implemented. Safety classification of components shall consider the provisions credited to manage such explosion risk and OHS hazard. [IO]

[RQ-32] [DRQ] Diborane detectors inside the port cell or at the exhaust line of DS shall be implemented. The response time must be assessed. [IO]

Segment 4 – VV

[RQ-37] [DRQ] Diborane explosion inside the pump shall not challenge pump integrity criteria. Cryopump shall be regenerated if inventory limit is achieved. [IO]

[RQ-38] [DRQ] Means for controlling the inventory of diborane on cryopump shall be defined and implemented. [IO]

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6.1.4 Design - Analyses

- Ex-vessel pipe distribution system, its supports, its spacers, including BGVB and Gas cabin shall be analyzed and designed with full justification and demonstration.
- An assessment of the worst case loading conditions, and the frequency of the worst case loading conditions shall be made to determine whether fatigue analysis is required, as set out in the SRD and LS [2, 8 & 9].
- The contractor shall comply with the requirements of ITER guidelines for Structural Analyses [33]
- The analyses shall be performed to meet all the loads and loads combination of the Load Specifications. Iterations is foreseen to achieve the final design, to achieve design optimization and to cope with clashes, limited space, pipe configuration, its support, its internal spacers, EP failures and interfacing loads when attached to other components supports.
- Internal spacers shall be designed, analyzed and qualified to meet the loads.
- PFP shall be taken into account since it brings additional loads.
    - Analysis checklists shall be used [57] [58]
- Interface with VV feedthrough shall be considered, designed and analysed.
- For some locations, supports are attached on the concrete wall using a plate attached to the wall using short HST stud anchor bolts from Hilti (50mm maximum depth inside the concrete). Design and analyses shall be considered as such for the design of this kind of supports.
- Mass balance and sizing calculation is available as in input document [13]

6.1.5 Design Implementation

6.1.5.1 Design – Mechanical piping system

The Boronization System shall be designed to retain its integrity during normal and all combinations of abnormal events, as set out in the SRD and Load Specifications [2, 8 & 9].

The EP capacity shall be verified and confirmed using the CBT tool [26].

The Boronization supports loads shall be provided to the common/shared support owner using the proposed IO template [57].

6.1.5.2 Design – Mechanical Gas cabin

The design shall be resilient to the calculated explosion energy[***59***]. The design shall incorporate fire safety provisions- as recommended by the Fire risk analysis -see 6.5. The design of the gas cabin shall be leaktight to ***better than 0.245volume/day with a 300Pa delta P. The gas cabin shall be demonstrated compatible with and robust to the Explosion hazard*** Case 1: Diborane in Helium 6.1.1 Equivalent mass of TNT ***[63]. The Design shall be compatible with the other requires described in[63].*** The IO shall provide the gas cabin part number and the Supplier shall be responsible for integration and supply of the gas cabin.

6.1.5.3 Design -Mechanical Boronization gas valve boxes

The gas valve boxes shall be doubly confined with an air equivalent overall BGVB secondary confinement leak tightness is **1e-5Pam^3/s.** The internal confinement barrier shall have a leak tightness of leak tightness is **1e-10Pam^3/s.** The connections of the internal barrier shall be welded as a first choice and where a dismountable flanges connection is required Swagelok VCR connections with locking mechanism shall be employed. The GVB shall have a dismountable cover allowing maintenance. The sealing o-ring of the dismountable cover shall be EPDM. The vacuum vessel isolation valves that exist between the BGVBs and the Vacuum vessel shall be

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the responsibility of the IO to procure. They shall be of the type VAT 48124-RE24-ARG1 with a DN16 Weldneck interface. https://www.vatgroup.com/series/uhv-all-metal-gate-valve. The IO shall provide a preliminary design of the BGVB with 3D and part numbers of the internal components. (Mass Flow Controllers, pressure sensors, valves etc)

6.1.5.4 Design - Constructability

The constructability of the piping, its support and spacers design shall be considered and demonstrated.

6.1.5.5 Design - Performance

The contractor shall confirm and update accordingly the Boronization GVB internal components layout and confirm that the internal components meet the design and performance requirements.

6.1.5.6 Design - Seismic

The design shall include provisions to minimize the potential of earthquakes to challenge confinement systems, as set out in the SRD and LS [2, 8 & 9].

6.1.5.7 Design - RAMI

Design – Implementation

The Boronization System shall be designed to be a highly reliable, efficient and a safe device. In order to achieve this, RAMI Analysis shall be performed in accordance with the ITER RAMI Analysis Program [57] to ensure the optimum system design and appropriate operation, testing and maintenance programs, as set out in the SRD [2]. The Reliability Block Diagrams shall provide availability estimate.

6.1.5.8 Design - Environmental conditions

The IO is responsible to provide the environmental parameters of the Boronization System, especially for sensitive items, like the magnetic field and the temperature in each room as part of the engineering design package.

6.1.5.9 Design - HAZOP

The IO shall perform a formal HAZOP to consider the hazard and risks associated with the Boronization System design and to identify safeguard to be implemented in the system and to be able to identify any show stopper or important issue. A preliminary HAZOP Level 1 has been conducted for the CDR [12].

6.1.5.10 Design - Cubicles

The cubicles type, quantities, internal components list, and locations shall be defined and shall be consistent with the already approved GIS I&C design.

6.1.5.11 Design - Deliverables

The deliverables to be completed for the design phase are listed in Appendix 3.

The contractor shall prepare all the deliverables, diagrams and drawings listed at least 2 months prior to the design review date to allow for enough time for the review and acceptance in IDM. New versions of each deliverable are foreseen to answer comments/feedbacks from the reviewers.

Each deliverable shall be accepted / approved at least 2 weeks prior to the design review to allow enough time for the panel members to review the documents.

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6.1.5.12 CM and DM models

The contractor shall assess and demonstrate consistency between CM and DM according to [55].

The contractor shall assess and demonstrate consistency between P&ID and DM

6.1.5.13 Design Review and Design Integration Review

The contractor shall support the preparation of the DIR slides (together with the IO) and support the resolution of the post meeting actions.

The contractor shall prepare and organize the FDR as per the Design Review Procedure [19].

The contractor shall prepare / support the preparation of the needed PowerPoint presentations for the FDR, and it shall be uploaded in IDM at least 1 week before the design review meeting.

The contractor shall follow-up with presenters to make sure that the presentations are all delivered on time for the design review meeting.

The contractor shall support the preparation of the design review notification, agenda, chit management and meeting minutes.

The contractor shall support the design review chair as per request, before, during and after the design review meeting.

6.1.5.14 Chit management and closure

The contractor shall support IO for the closure of the chits. A chit summary table to track the chit closure progress shall be prepared.

6.1.5.15 Standardization

Standard commercially available components, equipment, materials, and processes shall be used wherever possible. Specific components of sub-systems procured under this contract shall preferably be chosen from ITER standards catalogues. There are however also mandatory catalogued as decided by project policies and any selection deviating from the mandatory catalogue parts, such as the PLCs, shall be subject to a Deviation Request. [44]

The following catalogues are available / in phase of implementation at the ITER project:

- Standardized interfaces for all ITER plant system instrumentation and control can be found in the Plant Control Design Handbook [30]
- A catalogue for standard components for vacuum, Appendix 20 Standard Components to the Vacuum Handbook [27].

Where possible components, equipment, materials, and processes should be standardized across the system and be available from more than one source.

6.1.5.16 Operation and maintenance

Operation and Maintainability requirements are defined in the SRD [2] and includes special tools, spare parts and consumables.

6.1.5.17 Spare parts

Components procurement shall include spare parts as follows:

1- Pipes, Calculate length for installation then add 20% extra by length
2- Off-the-shelf items, short lead time (<3months), 10% extra
3- Specific items, long lead time (>3months), 20% extra

6.1.5.18 Software

Piping stress analyses shall be conducted using Caesar II.

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Support structural analyses shall be conducted using GT Strudl.

6.1.5.19 Internal and external supports

The FDR design shall keep, as much as possible, the predefined locations of all the supports (internal and primary/secondary supports) as well as the predefined EP or attachments to a common/shared supports.

The support's location and quantities are partly available in the 3D models and via the estimates of pipe span within this document

6.1.5.20 Materials

- Materials for structural metallic components such as pipes, supports, flanges, valves … shall be Austenitic Stainless Steel
  - To minimize activation of the materials exposed to neutron flux in ITER, the following chemical composition and impurity levels shall be (as per Material Spec of IO) [39]
  - For the majority of the ex-vessel locations neutron flux is low and so derogation can be sought for the low impurity requirements.
  - 3.1 Material certification according to EN 10204:2004 shall be provided to ensure compliance with impurity requirements. If compliance is not demonstrated due to missing elemental composition PMI testing shall occur and reports provided.
- Exhaustive full list of material shall be submitted to the IO for approval before any use. The Approval of the list by IO shall be identified as a PIA

6.1.5.21 ATEX

ATEX assessment is completed [50].

6.1.6 Service Duration

February 2026	Contract signature
February 2026	KoM
December 2026	FDR meeting
March 2027	Final design approved
May 2027 – June 2027	MRR
July 2027 – July 2028	Procurement, manufacturing, DRR and delivery
July 2028 – February 2031	Engineering support during installation

See Appendix 1, summary of key milestones

SUPPLY

6.2 Scope of Service – Pipe Design

6.2.1 Background

The IO performs a preliminary pilot analysis. The Supplier produces the following:

No.	Pipe stress Analysis	Notes
1	Ex vessel	CAESAR II to be used
2	Feedthroughs	FEA analysis to be completed. ANSYS or equivalent to be used
3	Ex vessel support structural analysis	STRUDL or equivalent to be used

6.2.2 Scope description

The scope is to update the analyses and to perform analyses of the remaining pipe sections.

The analysis shall be performed using Caesar II software version 2019 (or earlier version, to be agreed with IO). The analysis shall be performed with the following objectives:

- To evaluate the pipe stresses to confirm compliance with the design code and the IO document 'Allowable values and limits in Service Level C and D for ITER mechanical components' [17].
- To determine the appropriate functions of the piping supports (e.g. Z, guide, axial stop); and to identify if any more supports are needed, or if any of the supports can be removed.
- To ensure that the loads on the pipe supports during all operating conditions are within the defined limits
- To ensure that the pipe vertical sag remains below 3mm (criteria from [17]) under sustained load conditions, and that in operating conditions pipe displacements are within the defined limits to prevent clashes with adjacent systems.

The piping and support layout could be changed if required (to be agreed with the IO).

The locations of the piping supports are already defined but could change as per the piping stress analyses. The details of the piping support locations shall be provided in the isometrics drawings.

The Contractor shall determine the appropriate support functions (i.e. Z, Guide, Axial Stop, and any gaps required) at each of the support locations to ensure that the design meets the criteria for stresses, displacements and loads on supports.

Produce new pipe stress models for the missing lines.

There are a total of [TBD – Number to be finalized] sections.

All the lines shall be analyzed in a single pipe stress model.

Iterations are expected until no issues.

3D models shall be updated as per the analyses results.

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6.2.3 Piping layout with preliminary support locations

Complete 3D piping layout with preliminary support locations according to CAD design rules and requirements set within this document

6.2.4 Complete pipe stress analysis

Complete CAESAR pipe stress analysis iterations until system is passing and optimised. Generate reports and gain approval for documentation and supporting files via IDM.

6.2.5 Leak tightness requirements

Each of the pipe connections shall have a leak tightness of leak tightness of better than 1e-10Pam^3/s with a differential pressure of 1 atmosphere.

6.2.6 Inputs to Supplier

- Existing preliminary Caesar II piping models
- Existing 3D models
- Interfaces
- Material data
- SRD
- SLS (EM loads, Thermal loads …)
- Code and standards
- EM loads for in vessel piping
- Instructions for Analyses [31] [32]

6.2.7 Deliverables

The Contractor shall provide the final native files for all calculations performed including:
- Completed Caesar II model files
- Excel or mathcad files used for local stress calculations or other calculations
- Completed 3D models according to CAD rules.
- Structural integrity reports
- Pipe Stress analysis reports
- Isometrics

6.3 Scope of Service – Support Design

Support scope is the supports for the pipes and BGVB.

6.3.1 Background

Based on preliminary design work, there is about 1.5km of pipe with the estimated spans in *section 6 scope of work design*

In B13, B11 galleries and Port cells, pipes are attached to EP, other components supports or directly on the concrete wall or ceiling.

SUPPLY

There are no support designs, grouping or typical defined.

6.3.2 Scope description

- The contractor shall defined support groups and typicals.
- The contractor shall perform the design for each individual support and shall perform structural analysis calculations for each of the typical support assembly designs.
- The structural analysis calculations shall cover the enveloping load cases for all of the individual supports that are represented by the typical support design. This shall ensure that each support has a valid structural analysis calculation to demonstrate the adequacy of its design.
- For the purposes of estimating the work, it shall be assumed that there will be in total up to about 1000 individual supports, and no more than 25 typical support assembly designs.
- The Piping system is a Quality Class 1 System, as defined by Quality Classification Determination (24VQES v4.3). The calculations to be performed under this scope of work are classified as Protection Important Activities (PIAs)[41]. As such the process described in "Analyses and Calculations Analyses and Calculations (22MAL7 v5.1)" is mandatory. This process covers the activities associated with planning, preparing, technical checking, reviewing issuing, and revising analyses and calculations. In particular, it is required that a Quality Plan is prepared in accordance with Procurement Requirements for Producing a Quality Plan (22MFMW v4.0) for approval by IO; and that the calculations undergo Technical Checking and Independent Peer Review as defined in "Analyses and Calculations Analyses and Calculations (22MAL7 v5.1)" Other requirements associated with performing calculations classified as PIA are detailed in "Analyses and Calculations Analyses and Calculations (22MAL7 v5.1)".
- The task of Technical Checking is within the Contractor's Scope. The Independent Peer
- Review shall be performed by IO, and is outside of the Contractor's Scope. After completion of the calculations and the Technical Checking, the report shall be submitted for Independent Review. This is further described in Section 11.5.1, and the overall work process is shown in Figure 1 of "Analyses and Calculations Analyses and Calculations (22MAL7 v5.1)".
- Normal iterations, performed over the course of the various activities, are considered to be within the Contractor's scope of work.
- Further details of the activities within the Contractor's scope of work are provided in the following sections.

6.3.3 Activity 1 - Design of piping support assemblies

The Contractor shall design the piping support assemblies based on the preliminary design concepts and according to the space available in the IO 3D model. The design of the supports shall take into account the restraint type, and the loads and displacements obtained from the piping stress analysis calculation (by others).

The Contractor shall also review and, if necessary, modify the number and the configuration of the 'typical' support assembly designs that are required to represent all of the individual supports. The Contractor shall propose a final list of 'typical' designs, which shall be used as the basis for the structural analysis calculations.

In general, the support assemblies consist of primary and secondary support components:

- The primary support is the part of the support assembly which is directly connected to the pipe (typically COTS hardware).
- The secondary support is the part of the support assembly which is directly connected to the supporting structure, and supports the primary support.

SUPPLY

The Contractor shall perform the design of both the primary and secondary support components:

- For the primary support components, the Contractor shall select suitable COTS equipment from manufacturer's catalogues. COTS references available for the equipment selected shall be provided to IO.
- For the secondary supports, the Contractor shall select ASTM /EN standard profiles in accordance with the design code (seamless square or rectangular structural steel tubing shall be used whenever possible). The ends of all hollow sections shall be closed to avoid contamination inside the sections. All selected structural steel sections should be readily available.

The materials used in the manufacture of support assemblies shall be suitable for the operating and environmental conditions where they are located. Where support materials come into contact with the piping, they shall be of a compatible material.

Wherever possible, non-welded attachments shall be used for the primary support. Use of welded attachments to the pipe pressure boundary (lugs or similar) where required shall be at the approval of IO.

At the beginning of this activity, the contractor shall produce a Design Input Record of all the design information received from IO. This Design Input Record shall be updated periodically as required.

6.3.4 Activity 2 - Update of Catia 3D model with support assembly designs

CAD shall be implemented according to ITER rules defined in this document [55].

6.3.5 Activity 3 - Structural analyses of designed supports

Structural analysis shall occur according to ITER rules defined in this document

6.3.6 Activity 4 - Supports structural analyses report

Structural analysis shall be implemented based upon conditions described in this document and references [31] [32]

6.3.7 Activity 5 – Support assembly drawings

Support assembly drawings shall be implemented based upon conditions described in this document and reference [55]

6.3.8 Activity 6 – List of supports

List of supports shall be implemented according to ITER design rules using template [60]

6.3.9 Activity 7 – BoM

BOM shall be implemented according to ITER design rules using template and CATIA tools [56]

SUPPLY

6.3.10 Input

IO shall make available to the Contractor at the KoM of the WP the following documents:

- Load Specification
- Support list template
- Preliminary Embedded Plates (EP) list
- Design Guidelines
- Existing P&IDs
- Existing Isometrics
- Piping Specification
- Example support drawings
- CATIA non editable format (XML, 3Dlive or 3Dvia composer file) files showing the
- Existing preliminary piping and supports integrated with other systems and into the complete building environment

6.3.11 Deliverables

- Design records
- Final list of typical support assembly designs
- Final 3D mode updated with qualified support designs
- Final structural calculation software models after supports qualification
- Final supports drawings
- List of all the supports
- Bill of Materials
- Documentation schedule
- Software Verification and Validation dossier

6.4 Scope of Service – BGVB Design

shall make available to the Contractor at the KoM of the WP the following documents:

- Load Specification
- Support list template
- Preliminary Embedded Plates (EP) list
- Design Guidelines
- Existing P&IDs
- CATIA non editable format (XML, 3Dlive or 3Dvia composer file) files showing the
- Existing preliminary BGVB design integrated with other systems and into the complete building environment

6.4.1 Deliverables

- Design records
- Final list BGVB assembly designs
- Final 3D model according to CAD rules promoted in Enovia
- Final structural calculation software models and structural qualification report
- Final Manufacture and Installation drawings
- List of all the supports
- Bill of Materials
- Documentation schedule
- Software Verification and Validation dossier

SUPPLY

6.5 Scope of Service – Gas cabin Design

Cabin and concrete

A fire risk analysis shall be conducted by the Contractor to ensure that fire-related risks are effectively identified, managed and mitigated.

The fire risk analysis shall recommend firefighting/fire protection provisions tailored to the identified fire risks and considering the limited time the diborane gas will be available inside the cabin.

The Fire Protection provisions developed during the FDR design phase shall address the unique hazards and characteristics of the Gas cabin, ensuring full compliance with European norms, French fire safety regulations, and the specific requirements of the ITER Project.

Gas Cabin Fire Risk Analysis, Gas Cabin Fire Protection Provision descriptive document and BGS Fire Load document shall be provided at the FDR and updated at the subsequent contract milestones.

IO shall make available to the Contractor at the KoM of the WP the following documents:

- Load Specification
- Design Guidelines
- Existing P&IDs
- Existing Isometrics
- Piping Specification
- CATIA non editable format (XML, 3Dlive or 3Dvia composer file) files showing the

6.5.1 Deliverables

- Design records
- Design Justification document
- Final 3D mode updated with qualified support designs
- Documentation schedule
- Software Verification and Validation dossier

6.6 Scope of Service – I&C Design

BG I&C design shall be implemented to replicate existing GIS I&C [22],[23] & [24].

IO shall make available to the Contractor at the KoM of the WP the following documents:

- Design Guidelines
- Existing P&IDs
- Existing IS, PBS 43, 44, 45, 46, 48.01, 48.02
-

6.6.1 Deliverables

- Design records
- Design Justification document
- Final 3D model
- Documentation schedule
- Diagram - Electrical (single line diagram) of BG System

SUPPLY

- Description Document of BG System (including Functional Analysis, Machine State, Cubicles, Conventional, Interlock, and Safety)
- I&C Signal List of BG System
- I&C Data List of BG System
- Diagram - Electrical (single line diagram) of Xenon XRCS Gas Supply System
- Description Document of XRCS Gas Supply System (including Functional Analysis, Machine State, Cubicles, Conventional, Interlock, and Safety)
- I&C Signal List of XRCS Gas Supply System
- I&C Data List of XRCS Gas Supply System
- Update of IS, PBS 43, 44, 45, 46, 48.01, 48.02
-

7 Scope of Work - Manufacturing

7.1 Scope description and requirements

Taking the FDR deliverables, the manufacturing scope is as follows:

A- Prepare material specifications and component specifications needed to select material and component suppliers
B- Select suppliers
C- Develop detailed and complete documentation for the MRR together with the suppliers
D- Oversight suppliers work and ensure that it meets the requirements
E- Oversight delivery and perform delivery inspection accordingly

7.2 Input

7.3 Deliverables

Piping

- Close chits which could impact manufacturing
- 3D models shall be drafted and approved / frozen stage
- material technical specifications
- pipe BoM, supports BoM including spacers and all components needed
- list of valves and components
- 2D drawings of all the supports according to [59]
- GA drawings of the pipe network
- Isometric drawings
- Manufacturing process fluids and materials (e.g. cutting fluids, cleaning solvents …) shall be in accordance with the Appendix 3 Materials (27Y4QC) and Appendix 4 Accepted Fluids (2ELN8N)

I&C

- List of cubicles
- List of cables
- List of instruments
- Drawings of cubicles
- Catalogue references as needed …

Others

SUPPLY

- Detailed classifications of all sub-components
- General Technical Specifications to include manufacturing requirements such as MIP, delivery, packaging, FAT, SAT, list of deliverables, qualifications, procedures, welding requirements, cleanliness requirements, code and standards, NCR process. [45] [46] [47] [48][49]
- The Factory Acceptance Testing of the I&C systems will comply with the requirements of Plant Systems Factory Acceptance Plan for I&C systems Plant system I&C Integration plan (3VVU9W).

8 Scope of Work – Installation and Construction

8.1 Scope description and requirements

Taking into account design and manufacturing data, the installation and construction scope is as follows:

A- Prepare EWP as per IO guidelines and requirements
B- Install Boronization components as per design, integration and installation requirements

Guidelines and requirements as per EWP Tool box [25] EWP Toolbox link

8.2 Input

All relevant Installation documentation shall be provided by IO to supplier in support of the supplier's activities at the KOM.

8.3 Deliverables

Supplier shall

EWP are prepared, delivered and approved using ICP4.

9 Scope of Work – Post delivery services duration

Phase 1 duration is until the delivery of the parts at the IO + 6 months to address any receiving inspection issues

Phase 2 duration is phase 1 + 3 years to support and address any RFI, DR, field modifications and documentation update (e.g. supports dimensions changes, update of drawings and related documents)

SUPPLY

9.1 Engineering services

Any additional services not covered in this Technical Specification shall be managed by the method described below.

The contractor shall in their offer supply the fixed hourly manpower rates of the engineering work rates used for these works. In the offer the supplier shall propose a price revision formula.

To manage such an additional service IO shall issue for the service following this process.

1. The ITER Organization shall issue and send to the Supplier a Supply Request for any additional engineering service it may require from the Supplier.

2. The Supply Request shall include the following information.

- Scope of work
- Technical specification
- Required completion date
- Deliverables
- Deadline date for the Supply Offer submission
- Any other information required.

3. By the deadline date described in the Supply Request, the Supplier shall submit the financial and technical Supply Offer to the ITER Organization.

4. The Supply Offer shall include the following information:

- Compliance with the Supply Request
- Required total manpower hours and its breakdown

5. After the review of the Supply Offer, the ITER Organization may issue and send to the Supplier a Supply Order for the service it requires from the Supplier. The Supply Orders shall be prepared and sent by two original copies.

6. The Supply Order shall include the following information.

- Scope of work
- Quantity
- Unit price in EURO
- Total amount of order in EURO
- Required delivery timing
- Payment plan
- Point of contact in each Party during the implementation of the Task Order
- Deliverables
- Any other conditions required

10 Location for Scope of Work Execution

The Contractor can perform the work at their own location, but it is preferred to have key personnel at the IO for daily communication and make the progress more efficient.

11 IO Documents & IO Free issue items

IO shall free issue the Vacuum Vessel isolation valves to the Supplier.

SUPPLY

12 Deliverables and Schedule Milestones

12.1.1 Schedule for delivery

Delivery need date	**Description**
July 2028	He/Diborane cylinder cabin
January 2029	Pipes and supports for diborane gas distribution BGVB, control and safety isolation valves I&C components

Reference ID	**Description**	**UOM**	**Quantity**	**Delivery Time***	**Comment**
Delivery 1	He/Diborane cylinder cabin	*Piece*	*1*	July 2028	
Delivery 2	Pipes and supports for diborane gas distribution and XRCS gas supply system BGVBs, control and safety isolation valves I&C components for both systems	*Piece*	*1*	January 2029	

Please find hereafter the expected detailed schedule:

Schedule Milestones	**Description**	**Is Contract Gate? (Y/N)**	**Expected Timing (T0+x) ***
#1	FDR XRCS	Y	8 months
#2	FDR BG	Y	9 months
#3	MRR XRCS	Y	12 months
#4	MRR BG	Y	15 months
#5	DRR Gas Cabin Delivery 1 Scope	Y	22 months
#6	DRR Pipes and supports for diborane gas distribution and XRCS gas supply system BGVBs, control and safety isolation valves I&C components for both systems. Delivery 2 Scope.	Y	24 months

* TO = KOM date.

12.1.2 List of deliverable documentation

The Supplier shall provide IO with the documents and data required in the application of this technical specification, the GM3S Ref [1] and any other requirement derived from the application of the contract.

You can find here below a minimum list of documentation, but not limited to, that are required within the expected timing:

Category	Document Type	Further Description	Expected Timing (T0+x) *
Design	KoM	List Appendix 3	
	Progress meeting	List Appendix 3	
	FDR	List Appendix 3	
Manufacturing	Preparation	List Appendix 3	
	MRR	List Appendix 3	
	Delivery	List Appendix 3	

(*) T0 = Commencement Date of the contract ; X in months.

Supplier shall prepare their document schedule based on the above and using the template available in the GM3S Ref [1] appendix II (click here to download).

13 Quality Assurance requirements

The Quality class under this contract is described in section 5.1 of this document. [Ref 1] GM3S section 8 applies in line with the defined Quality Class. Compliance with IO procedure 22MFG4 shall be ensured.

14 Safety requirements

The Safety class under this contract is described in section 5.2 of this document. "The scope under this contract covers for PIC and/or PIA and/or PE/NPE components, [Ref 1] GM3S section 5.3 applies. "

14.1 Nuclear class Safety

The Nuclear Safety class under this contract is described in section 5.2 of this document.

14.2 Seismic class

The Seismic class under this contract is described in section 5.2 of this document.

15 Special Management requirements

State here if “Requirement for [Ref 1] GM3S section 6 applies in full ” and remove the below or “Requirement for [Ref 1] GM3S section 6 applies completed/amended with the below specific requirements:”

15.1 Contract Gates

In addition to the contract gates as defined in [Ref 1] section 6.1.5, the scope of work call for Contract gates as defined in section 5 of this document

.

15.2 CAD design requirements

This contract requires for CAD activities, [Ref 1] GM3S section 6.2.2.2 applies

16 Appendices

16.1 Appendix 1 – Phases and Milestones

Summary of key milestones

- FDR
- MRR
- Delivery
- Installation

Dates	**Milestone Description**
January 2026	Contract signature
January 2026	KoM
November 2026	FDR meeting
February 2026	Final design approved
April 2027 – June 2027	MRR
July 2027 – July 2028	Procurement and manufacturing
July 2028 – February 2031	Engineering support during installation and optional installation

Delivery need date	**Description**
July 2028	He/Diborane cylinder cabin
January 2029	Pipes and supports for diborane gas distribution BGVB, control and safety isolation valves I&C components

16.2 Appendix 2 – Minimum required HP and PIA for the contract

	Control Point	PIA (Y/N)	Comment
Tender			
Contract awarded	HP	N	
Final Design			
Kick-Off Meeting	HP	N	
Quality Plan approved by IO	HP	Y	
Model review	HP		
PFD review	HP		
P&ID review	HP		
HAZOP review	HP		
FDR meeting	HP	Y	
Chits closure	HP		
Pre-fabrication Activities			
MRR meeting	HP	Y	
Material receiving inspection	HP	Y	
Welding consumables verification	HP	Y	
Qualification of Welders and Welding Procedures	HP	Y	
Workshop cleanliness inspection	HP	N	
Manufacturing Activities			
Marking and Identification of pipes, supports …	HP	N	

Cleaning of pipes, bellows, hoses, fittings	HP	N	
Welding	HP	Y	
RT tests	HP	Y	
He leak tightness of assembly	HP	Y	
Dimensional and visual inspection	HP	N	
Cleanliness inspection	HP	N	
Packing and Shipping			
Conditioning of the parts	HP	N	
Manufacturing Dossier	HP	Y	
Delivery documentation (CRN, packing list …)	HP	Y	
Receiving inspection at the IO	HP	Y	

16.3 Appendix 3 – Contractor deliverables for each phase and milestone

16.3.1 Expected list of deliverables for the Boronization FDR

The FDR preparation and list of deliverables shall be proposed by the Contractor in accordance with the DR procedure [18], the SDP Working Instruction [19] and the Template for SDR Input Data Package [20]. A representative example of the Boronization System FDR List of deliverables and Activity responsibility is shown below for the purpose of supplier cost estimation.

Aspect *Select the main Aspect to guide you to the Document selection*	Expected Document	ICP Doc Type	FDR Maturity *[illegible]*	Responsibility
[Design Requirements]	System Requirements Document-SRD (or Sub-SRD)	System Requirements Document-SRD	complete	IO
[Design Requirements]	Interface Control Document-ICD	Interface Control Document-ICD	complete	IO
[Design Requirements]	Interface Sheet-IS	Interface Sheet-IS	complete	IO/Contractor
[Design Requirements]	Configuration Management Model-CMM	Please provide CMAF Ref	complete	IO
[Design Requirements]	System Load Specification	Load Specification	complete	IO
[Design Definition]	System Design Description-DDD	System Design Description-DDD	complete	IO
[Design Definition]	System Layout Drawing	System layout drawing	complete	Contractor
[Design Definition]	Building Drawing	Site & Building Drawing	complete	Contractor
[Design Definition]	Process Flow Diagram-PFD	Process Flow Diagram-PFD	complete	IO
[Design Definition]	Piping and Instrumentation Diagram-PID	Piping and Instrumentation Diagram-PID	complete	IO
[Design Definition]	Single Line Diagram or One Line Diagram	Single Line Diagram	complete	Contractor
[Design Definition]	Cabling Diagram-CBD	Cabling Diagram-CBD	complete	IO
[Design Definition]	Detailed Wiring Diagram-WD	Detailed Wiring Diagram-WD	complete	IO
[Design Definition]	Plant System Instrumentation and Control Specification	Technical Requirements Specification	complete	Contractor
[Design Definition]	Instrumentation and Control - List of Signals	Instrumentation and Control Document	complete	Contractor
[Design Definition]	List of Data at Central Instrumentation and Control Interface	Instrumentation and Control Document	complete	Contractor
[Design Definition]	Cubicle Hardware Configuration Diagram	Instrumentation and Control Document	complete	Contractor
[Design Definition]	Description of Plant System State Machines	Instrumentation and Control Document	complete	IO
[Design Definition]	Instrumentation and Control - Physical and Functional Architecture	Instrumentation and Control Document - Physical and Functional Architecture	complete	Contractor
[Design Definition]	Equipment or Component List	Component list	complete	Contractor
[Design Definition]	Bill of Material - BOM	Bill of Material - BOM	complete	Contractor
[Design Definition]	Component Technical Specification	Technical Requirements Specification	complete	Contractor
[Design Definition]	Assembly Drawing	Piping Isometric Drawing	complete	Contractor
[Design Definition]	Assembly Drawing	Support Drawing	complete	Contractor
[Design Definition]	Cubicle Internal Definition	Cubicle Internal Definition	complete	Contractor
[Design Justification]	Design Justification Plan-DJP	Verification and Validation Plan	complete	IO
[Design Justification]	Design Compliance Matrix - DCM	Compliance Matrix - DCM or VCM or ICM	complete	IO
[Design Justification]	Interface Compliance Matrix	Compliance Matrix - DCM or VCM or ICM	complete	IO
[Design Justification]	Calculation report-gas flow	Calculations	complete	IO
[Design Justification]	In vessel supports structural analysis	Engineering Analysis	complete	IO
[Design Justification]	Ex vessel supports structural analysis	Engineering Analysis	complete	Contractor
[Design Justification]	Ex vessel pipe stress analysis	Engineering Analysis	complete	Contractor
[Design Justification]	In vessel pipe stress analysis	Engineering Analysis	complete	Contractor
[Design Justification]	Hazard Identification and Risk Analysis (HIRA)	Engineering Analysis	complete	IO
[Design Justification]	RAMI Analysis	Engineering Analysis	complete	IO
[Design Justification]	Hazard and Operability Study (HAZOP)	Engineering Analysis	complete	IO
[Design Justification]	Human and Organisational Factor Analysis (HOF)	Engineering Analysis	complete	IO
[Design Justification]	Remote Handling Compatibility Report (Remote Handling Compatibility Assessment Report, Mock up report)	Engineering Analysis	complete	IO
[Design Justification]	Qualification Plan	Qualification Plan	complete	IO
[Design Justification]	Acceptance Plan (FAT, SAT)	FAT & SAT Plan and Procedure	complete	IO
[Design Justification]	Requirement Validation Matrix	Compliance Matrix - DCM or VCM or ICM	complete	IO
[Design Justification]	ROX and Research and Development Report	ROX and Research and Development Report	complete	IO
[Commissioning]	System Commissioning Plan	Commissioning Plan	complete	IO
[Commissioning]	Commissioning Test Procedure	Commissioning Test Procedure	complete	IO
[Manufacturing]	Part Drawing	Part Drawing	complete	Contractor
[Assembly and Installation]	Installation Drawing	Installation Drawing	complete	Contractor
[Assembly and Installation]	Assembly or Installation Plan	Installation Execution Document	complete	Contractor
[Operation and Maintenance]	Concept of Operations	Concept of Operation	complete	IO
[Operation and Maintenance]	System Maintenance and In-Service Inspection Plan	System Maintenance and In-Service Inspection Plan	complete	Contractor
[Decommissioning]	Decommissioning Plan	Decommissioning Document	complete	IO
[Decommissioning]	Radwaste Checklist	Decommissioning Document	complete	IO
Non Technical Documents				
[Other]	Issue or Risk or Opportunity Analysis Report	Please Provide PROR DataBase Link	complete	IO

The IO shall review and approve the list of deliverables.

16.3.2Expected list of deliverables for the Boronization MRR

The MRR preparation and list of deliverables shall be proposed by the Contractor in accordance with the Template for SDR Input Data Package [21]. A representative example of the Boronization System MRR List of deliverables and Activity responsibility is shown below for the purpose of supplier cost estimation.

Aspect *Select the main Aspect to guide you to the Document selection.*	Expected Document	ICP Doc Type	MRR Maturity *(Please don't change values)*	Responsibility
[Design Requirements]	Configuration Management Model-CMM	Please provide CMAF Ref	If Useful	IO
[Design Definition]	Building Drawing	Site & Building Drawing	Complete	Contractor
[Design Definition]	Cabling Diagram-CBD	Cabling Diagram-CBD	Complete	Contractor
[Design Definition]	Detailed Wiring Diagram-WD	Detailed Wiring Diagram-WD	Complete	Contractor
[Design Definition]	Instrumentation and Control Document	Instrumentation and Control Document	Complete	Contractor
[Design Definition]	Instrumentation and Control - Physical and Functional Architecture	Instrumentation and Control Document - Physical and Functional Architecture	Complete	Contractor
[Design Definition]	Equipment or Component List	Component list	Complete	Contractor
[Design Definition]	Bill of Material - BOM	Bill of Material - BOM	Complete	Contractor
[Design Definition]	Component Technical Specification	Technical Requirements Specification	Complete	Contractor
[Design Definition]	Assembly Drawing	Piping Isometric Drawing	Complete	Contractor
[Design Definition]	Assembly Drawing	Support Drawing	Complete	Contractor
[Design Definition]	Assembly Drawing	Assembly Drawing	Complete	Contractor
[Design Definition]	Cubicle Internal Definition	Cubicle Internal Definition	Complete	Contractor
[Design Justification]	Compliance Matrix - DCM or VCM	Compliance Matrix - DCM or VCM or ICM	Complete	IO
[Design Justification]	Qualification Plan	Qualification Plan	Complete	IO
[Design Justification]	Qualification Summary Report for PIC Com	Qualification Synthesis Report for PIC Component	Complete	IO
[Design Justification]	Acceptance Plan (FAT, SAT)	FAT & SAT Plan and Procedure	Complete	IO
[Design Justification]	Factory Acceptance Test Procedure	FAT & SAT Plan and Procedure	Complete	IO
[Manufacturing]	Manufacturing Inspection Plan-MIP	Manufacturing Inspection Plan-MIP	Complete	Contractor
[Manufacturing]	Manufacturing Instruction or Procedure	Manufacturing execution document	Complete	Contractor
[Manufacturing]	Non-destructive Examination Procedure	Manufacturing execution document	Complete	Contractor
[Manufacturing]	List of Manufacturing Tools and Equipmen	Manufacturing execution document	Complete	Contractor
[Manufacturing]	Manufacturing Process Qualification Repo	Manufacturing execution document	Complete	Contractor
[Manufacturing]	Training or Qualification Record	Manufacturing execution document	Complete	Contractor
[Manufacturing]	Data Sheet	Manufacturing execution document	Complete	Contractor
[Manufacturing]	Manufacturing Drawing	Manufacturing Drawing	Complete	Contractor
[Manufacturing]	Part Drawing	Part Drawing	Complete	Contractor
[Operation and Maintenance]	Operation and Maintenance Manual	Equipment Operation and maintenance Manual	Preliminary	IO

•

[Design Justification]	Structural Integrity Report	Engineering Analysis	Complete	Contractor	in vessel support structural analysis
[Design Justification]	Structural Integrity Report	Engineering Analysis	Complete	Contractor	Ex vessel supports structural analysis
[Design Justification]	Structural Integrity Report	Engineering Analysis	Complete	Contractor	Ex vessel pipe stress analysis
[Design Justification]	Structural Integrity Report	Engineering Analysis	Complete	Contractor	In vessel pipe stress analysis
[Design Justification]	Hazard Identification and Risk Analysis (HIRA)	Engineering Analysis	Complete	IO	
[Design Justification]	RAMI Analysis	Engineering Analysis	Complete	IO	
[Design Justification]	Hazard and Operability Study (HAZOP)	Engineering Analysis	Complete	IO	
[Design Justification]	Human and Organisational Factor Analysis (HOF)	Engineering Analysis	Complete	IO	
[Design Justification]	Remote Handling Compatibility Report (Remote Handling Compatibility Assessment Report, Mock up report)	Engineering Analysis	Complete	IO	
[Design Justification]	Qualification Plan	Qualification Plan	Preliminary	IO	
[Design Justification]	Acceptance Plan (FAT, SAT)	FAT & SAT Plan and Procedure	Preliminary	IO	
[Design Justification]	Requirement Validation Matrix	Compliance Matrix - DCM or VCM or ICM	Complete	IO	
[Design Justification]	ROX and Research and Development Report	ROX and Research and Development Report	If Useful	IO	
[Commissioning]	System Commissioning Plan	Commissioning Plan	Complete	IO	
[Commissioning]	Commissioning Test Procedure	Commissioning Test Procedure	Preliminary	IO	
[Manufacturing]	Part Drawing	Part Drawing	Preliminary	Contractor	
[Assembly and Installation]	Installation Drawing	Installation Drawing	Complete	Contractor	
[Assembly and Installation]	Assembly or Installation Plan	Installation Execution Document	Complete	Contractor	
[Operation and Maintenance]	Concept of Operations	Concept of Operation	Complete	IO	
[Operation and Maintenance]	System Maintenance and In-Service Inspection Plan	System Maintenance and In-Service Inspection Plan	Complete	Contractor	
[Decommissioning]	Decommissioning Plan	Decommissioning Document	Complete	IO	
[Decommissioning]	Radwaste Checklist	Decommissioning Document	Complete	IO	
Non Technical Documents					
[Other]	Issue or Risk or Opportunity Analysis Report	Please Provide PROR DataBase Link	At any stage	IO	

The IO shall review and approve the list of deliverables

16.3.3 Expected list of deliverables of the I&C design

The control system of the Boronization system and Xe gas delivery system is expected to be a replica of the GIS I&C system.

The deliverables shall be prepared as per the PCDH guidelines Plant Control Design Handbook (27LH2V) and Methodology for Plant System I&C specifications (353AZY).

This document completes the PCDH core document by focusing on methodology for plant system I&C technical specifications. It aims to give guidelines to issue the deliverables for the design phase as mentioned in PCDH, scope and workflow for I&C design data.

16.3.4 Expected list of deliverables for the Xenon gas supply FDR

The FDR preparation and list of deliverables shall be proposed by the Contractor in accordance with the DR procedure [18], the SDP Working Instruction [19] and the Template for SDR Input Data Package [20]. A representative example of the Xenon gas supply System FDR List of deliverables and Activity responsibility is shown below for the purpose of supplier cost estimation.

Aspect	ICP Doc Type	Title	Responsibility
[Design Definition] (A. Design Requirements)	Technical Requirements Specification	SRD	IO
[Design Definition] (A. Design Requirements)	Configuration Management Model-CMM	CMM	IO
[Design Definition] (B. Design Description)	Design Description	DDD	IO
[Design Definition] (B. Design Description)	Load Specification	Load Specifications	IO
[Design Definition] (B. Design Description)	Component Technical specifications	Technical Specification for Bellows Procurement	IO/Supplier
[Design Definition] (B. Design Description)	Process Diagram	PFD	IO
[Design Definition] (B. Design Description)	Process Diagram	P&IDs	IO
[Design Definition] (B. Design Description)	Instrumentation and Control Diagram	Cabling diagrams	IO
[Design Definition] (B. Design Description)	Bill Of Material-BOM	BOM	Supplier
[Design Definition] (B. Design Description)	Design Description	Engineering models and drawings	Supplier
[Definition Justification]	Verification Report	Compliance Matrix	Supplier
[Definition Justification]	Functional Analysis Report-FAR	Functional Analysis Report-FAR	IO
[Definition Justification]	Engineering Analysis and Calculation Report	Structural Integrity analysis report	Supplier
[Definition Justification]	Engineering Analysis and Calculation Report	Leak Detection Scheme and Analyses	IO
[Definition Justification]		RAMI	IO
[Definition Justification]		HAZOP	IO
[Definition Justification]		HIRA	IO
[Manufacturing]	Assembly drawing	Assembly Drawings	Supplier
[Manufacturing]	Other Manufacturing Input	Factory Qualification Tests Plan	Supplier
[Manufacturing]	Part drawing	Part drawings	Supplier
[Assembly and Installation]		On-site Assembly Plan	Supplier
[Assembly and Installation]		He Leak Testing on Site Assembly	Supplier
[Operation and Maintenance]	Concept of Operations	Operations plan	IO
[Operation and Maintenance]	Maintenance or Inspection Plan	Maintenance Plan	IO
[Product Lifecycle Records] (B. Procurement)	Deliverable List (Review or Decision or Recommendations Report)	Deliverable List	IO

16.3.5 Expected list of deliverables for the Xenon gas supply MRR

The MRR preparation and list of deliverables shall be proposed by the Contractor in accordance with the Template for SDR Input Data Package [21]. A representative example of the Xenon Gas Supply System MRR List of deliverables and Activity responsibility is shown below for the purpose of supplier cost estimation.

Aspect *Select the main Aspect to guide you to the Document selection.*	**ICP Doc Type**	**Title**	**Responsibility**	**Notes**
[Design Justification]	FAT & SAT Plan and Procedure	Factory Acceptance Test Program	IO	
		Site Acceptance Test Program	IO	
[Manufacturing]	Manufacturing Inspection Plan-MIP	Manufacture Inspection Plan	IO/Supplier	IO to define Notification and Hold Points
[Manufacturing]	Manufacturing execution document	Welding Procedure	Supplier	
		Welding Process Specification	Supplier	
		Helium Leak Test Procedure	Supplier	
[Manufacturing]	Manufacturing execution document	Liquid Penetrant Examination Procedure	Supplier	
		Visual Examination Procedure	Supplier	
		Radiographic Examination Procedure	Supplier	
[Manufacturing]	Manufacturing execution document	Welding Qualification Report	Supplier	
[Manufacturing]	Manufacturing execution document	Personnel Qualification	Supplier	
[Manufacturing]	Manufacturing Drawing	Manufacturing Drawingы	Supplier	
[Other]		Quality Plan	IO/Supplier	

16.4 Appendix 4 – Installation and Construction Work Packages

EWP Toolbox link [25]

The contractor shall follow the instructions in the tool box to implement according to IO process