外部委託業者の募集

References: IO/25/OT/10033007/VML

"Supply Contract for Design, Manufacturing and Qualification of VVPSS Gas Heaters"

（VVPSS ガスヒータの設計、製造、品質確認の供給契約）

IO 締め切り 2025 年 9 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

今回の入札プロセスは、VVPSS（真空容器圧力緩和システム）のためのガスヒータの設計、製造、品質確認の供給契約を締結することを目的としています。

この契約には、以下の2つのフェーズが含まれます。

作業範囲としては、プロジェクトの構造的、機能的及び法規制の要件に完全に準拠し、適格なVVPSSガスヒータの搬入を保証するために必要なすべての作業をカバーします。

詳細については、付属書II：技術仕様書 EAS7L6 v1.4.を参照してください。

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 8 月 27 日
関心表明フォームの提出	2025 年 9 月 12 日
入札会議（Teams にて）	2025 年 10 月 9 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	2025 年 11 月 4 日
契約授与	2025 年 11 月 E
契約調印	2025 年 12 月

〇契約期間と実行

ITER機構は2025年の12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18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 for Design, Manufacturing and Qualification of VVPSS Gas Heaters」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。

china eu india japan korea russia usa
Route de Vinon-sur-Verdon - CS 90 046 - 13067 St Paul Lez Durance Cedex - France

PRIOR INDICATIVE NOTICE (PIN)

OPEN TENDER SUMMARY

IO/25/OT/10033007/VML

for

Supply Contract
Design, Manufacturing and Qualification of VVPSS Gas Heaters

Prior Indicative Notice annexes:
- Annex I: Expression of Interest Form
- Annex II: Technical Specifications EAS7L6 v1.4.

IO Contact Persons: Virginie.Michel@iter.org and Andrew.Brown@iter.org

Abstract

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

1 Introduction

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

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 Supply

The scope of this procurement is for the design, fabrication, inspection, testing and qualification of the gas heaters procured for the ITER Vacuum Vessel Pressure Suppression System (VVPSS). The scope covers all activities necessary to ensure the delivery of fully compliant and qualified VVPSS heaters, meeting the project's structural, functional and regulatory requirements.

For the full scope of services, please see the attached Technical Specifications, ref. EAS7L6 v1.4.

4 Procurement Process & Objective

The objective is to award a Supply Contract through a competitive bidding process.

The Procurement Procedure selected for this Tender is a so-called **Open Tender** procedure.

The Open Tender procedure is comprised of the following four main steps:

- Step 1- Prior Information Notice (PIN)

  The PIN 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 in the procurement timetable below.

  Special attention:

  Interested tenderers are kindly requested to register in the IO Ariba e-procurement tool called "I-PROC". You can find all links to proceed along with instruction going to: https://www.iter.org/fr/proc/overview.

  When registering in Ariba (I-PROC), 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 – Request for Proposal (RFP)

  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 works 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 with a sharing of 60% for the technical offer and 40% for the financial offer 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)	27 August 2025
Submission of expression of interest form	No later than 12 September 2025
Request for Proposal launched on I-PROC	No later than 23 September 2025
Tenderers Conference (via teams)	9 October 2025
Clarification Questions (if any) and Answers	5 days before submission deadline
Tender Submission	4 November 2025 (or
Contract Award	End November 2025
Contract Signature	December 2025

5 Quality Assurance Requirements

The Candidate shall have ISO 9001 or shall submit to the IO for approval its "Quality Assurance Program'' in the Tender Submission for the IO's review and acceptance.

6 Contract Duration and Execution

The IO shall award the Contract around December 2025. The Time for Completion is 18 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 IO.

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 IO 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.

All consortium members shall be registered in I-PROC.

8 Sub-contracting Rules

Subcontracting is limited to 40 % of the contract value and up to level 2.
All sub-contractors who will be taken on by the Contractor shall be declared with the Tender submission in I-PROC. 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: Virginie.Michel@iter.org with Andrew.Brown@iter.org in cc

Tender reference: **IO/25/OT/10033007/VML**
Description: **Design, Manufacturing and Qualification of VVPSS Gas Heaters**

Procurement Officer: **Virginie Michel - Procurement Division ITER Organization**

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

☐ WE INTEND TO SUBMIT A TENDER

Are you registered in Iproc (only entities registered in iPROC will be invited to tender):

☐ YES

Please indicate your registration number: ……

☐ NO, but we shall register before the indicated tender launch date

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
EAS7L6

VERSION CREATED ON / VERSION / STATUS
22 Aug 2025 / 1.4 / Approved

EXTERNAL REFERENCE / VERSION

Technical Specifications (In-Cash Procurement)

Technical Specification for Design, Manufacturing and Qualification of VVPSS Gas Heaters

This technical specification outlines the requirements for the design, fabrication, inspection, testing and qualification of the gas heaters procured for the ITER Vacuum Vessel Pressure Suppression System (VVPSS). The scope covers all activities necessary to ensure the delivery of fully compliant and qualified VVPSS heaters, meeting the project's structural, functional and regulatory requirements.

1 PREAMBLE

This Technical Specification is to be read in combination with the General Management Specification for Service and Supply (GM3S) – [AD- 21] that constitutes a full part of the technical requirements.

In case of conflict, the content of the Technical Specification supersedes the content of [AD- 21].

2 PURPOSE

The purpose of this document is to describe the technical requirements for the design, equipment qualification, manufacturing and delivery of the Gas Heaters for the Vacuum Vessel Pressure Suppression System.

3 ACRONYMS

For a complete list of the ITER abbreviations, see ITER_D_2MU6W5. The abbreviations listed below shall have the following meanings where used:

ALARA – As Low As Reasonably Achievable
ANB – Agreed Notified Body
ASME – American Society of Mechanical Engineers
ASN – Autorite de Surete Nucleaire (French nuclear safety authority)
ASTM – American Society for Testing and Materials
DN – Nominal Diameter
DTR – Drain Tank Room
DW - Dead Weight
EN – European Standard
ESP – Equipements Sous Pression
ESPN – Equipements Sous Pression Nucléaires
HRA - Hazard and Risk Analysis
I&C – Instrumentation and Controls
ICE – Ingress of Coolant Event
INB – Installation nucléaire de base (Basic nuclear installation)
IO – ITER Organization
ISO – International Organization for Standardization
LOCA – Loss Of Cooling Accident
LOVA – Loss of Vacuum Accident
MIP – Manufacturing and Inspection Plan
MRR – Manufacturing Readiness Review
MQP – Manufacturing Quality Plan
NCR - Non Conformity Report
NDE – Non-destructive Examination
NPMA - Nuclear Particular Material Appraisal
NO - Normal Operation
PBS – Plant Breakdown Structure
PED – Pressure Equipment Directive (equiv. ESP)
PIA – Protection Important Activity
PIC – Protection Important Component
PQR – Procedure Qualification Record
RTPO - Recognized Third Party Organization
SEP - Sound Engineering Practice
SSEN - Steady State Electrical Network
QA – Quality Assurance
QP – Quality Plan
SIC – Safety Importance Class
VVPSS – Vacuum Vessel Pressure Suppression System
WPS – Welding Procedure Specification

4 APPLICABLE DOCUMENTS & CODES AND STANDARDS

The orders, directives, codes and standards used in this contract are listed in Table 1. Other standards may also be acceptable, subject to IO's approval. The Contractor shall demonstrate conformity with the orders, directives, codes and standards in their last version.

For items not covered by the prod codes and technical specifications, the Contractor shall justify the soundness of the design approach.

For the ITER Applicable and Reference Documents, the last approved version applies. IO will notify the Contractor if any of the documents listed in the table below will be updated.

Table 1, List of Applicable documents, Codes and Standards

Codes and Standards		
[AD- 1]	EN 13480:2017	Metallic industrial piping
[AD- 2]	RCC-M:2022	RCC-M Section VI Design and Construction Rules for Mechanical Components of PWR Nuclear Islands, Volume "Q" Qualification of Active Mechanical Equipment Requirements Qualification to Accident Conditions
[AD- 3]	RCC-E:2022	Design and Construction Rules for Electrical and I&C Systems and Equipment
[AD- 4]	IEC/IEEE 60980-344	Nuclear facilities – Equipment important to safety – Seismic qualification
[AD- 5]	EN 10204:2004	Metallic products – Type of inspection documents
[AD- 6]	ISO 17025:2017	General requirements for the competence of testing and calibration laboratories
[AD- 7]	EN 1092-1:2018	Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories PN designated – Part 1: Steel flanges.
[AD- 8]	EN 1515-4:2009	Flanges and their joints - Bolting - Part 4: Selection of bolting for equipment subject to the Pressure Equipment Directive 2014/68/EU
[AD- 9]	ASME B18.21.1:2009	Heavy Helical Spring Lock Washers
[AD- 10]	EN 1591:2013	Flanges and their joints - Design rules for gasketed circular flange connections - Part 1: Calculation
[AD- 11]	EN 3834-2:2021	Quality requirements for fusion welding of metallic materials - Part 2: Comprehensive quality requirements
[AD- 12]	EN 15614-1:2017	Specification and qualification of welding procedures for metallic materials – Welding procedure test – Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys
[AD- 13]	ISO 9692:2013	Welding and allied processes — Types of joint preparation — Part 1: Manual metal arc welding, gas-shielded metal arc welding, gas welding, TIG welding and beam welding of steels
[AD- 14]	EN 2516:1989	Aerospace series - Passivation of corrosion-resisting steels and decontamination of nickel base alloys
[AD- 15]	ISO 9712:2012	Non-destructive Testing - Qualification and Certification of NDT Personnel
[AD- 16]	EN 17637:2016	Non-destructive testing of welds - Visual testing of fusion-welded joints
[AD- 17]	ISO 10675-1:2022	Non-destructive testing of welds — Acceptance levels for radiographic testing — Part 1: Steel, nickel, titanium and their alloys
[AD- 18]	EN 11666:2018	Non-destructive testing of welds - Ultrasonic testing - Acceptance levels

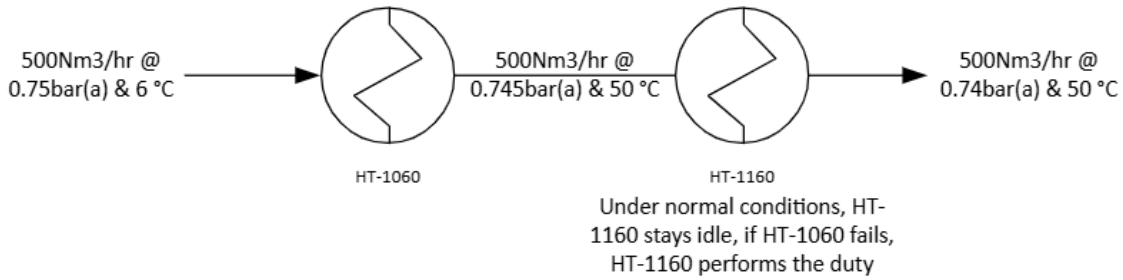
[AD- 19]	EN 17640:2018	Non-destructive testing of welds — Ultrasonic testing — Techniques, testing levels, and assessment
[AD- 20]	EN 9606-1:2017	Qualification testing of welders – Fusion welding – Part 1: Steels
ITER Applicable Documents		
[AD- 21]	ITER_D_82MXQK	General Management Specification for Service and Supply (GM3S)
[AD- 22]	ITER_D_XB5ABP	Qualification of Protection Important Components (PIC)
[AD- 23]	ITER_D_ADCXXD	Guidelines for qualification of mechanical equipment
[AD- 24]	ITER_D_ADD99Y	Guidelines for qualification of electrical and I&C equipment
[AD- 25]	ITER_D_AHNMBK	Guidelines for qualification of I&C System and Software
[AD- 26]	ITER_D_KTU8HH	Software qualification policy
[AD- 27]	ITER_D_35BVV3	Instructions for Structural Analyses
[AD- 28]	ITER_D_AKFUMQ	Guidelines for qualification by analysis
[AD- 29]	ITER_D_VT29D6	Instruction for Seismic Analysis
[AD- 30]	ITER_D_AGL2QP	Technical Specification for the Experimental Seismic Qualification of Active Electrical and Mechanical Components
[AD- 31]	ITER_D_98JL4W	Test method for ITER equipment for static magnetic fields
[AD- 32]	ITER_D_2LTQ96	Radioprotection guide for ESPN application
[AD- 33]	ITER_D_44SZYP	Working Instruction for Manufacturing Readiness Review
[AD- 34]	ITER_D_22MFG4	Quality Requirements for IO Performers
[AD- 35]	ITER_D_X3NEGB	Working Instruction for the Delivery Readiness Review (DRR)
[AD- 36]	ITER_D_28QDBS	ITER Numbering System for Components and Parts
[AD- 37]	ITER_D_VQVTQW	Template for Structural Analysis Reports
[AD- 38]	*ITER_D*_BK7Y2G	Template for Equipment Identification file
[AD- 39]	ITER_D_AQKXEH	Template for Qualification Strategy
[AD- 40]	ITER_D_BXTPJP	Template for Qualification Dossier
[AD- 41]	ITER_D_BXTNRJ	Template for Qualification follow-up document
[AD- 42]	ITER_D_BXTLMX	Template for Qualification Preservation Sheet
[AD- 43]	ITER_D_B9HR4D	Template for Qualification Plan
[AD- 44]	ITER_D_BXTDJE	Template for Qualification Synthesis Report
[AD- 45]	ITER_D_BXD2SS	Template for Qualification Test Specifications
[AD- 46]	ITER_D_BXTMAL	Template for Reference File
[AD- 47]	ITER_D_BXSQE9	Template for Qualification Test Report
[AD- 48]	ITER_D_AKFUMQ	Guidelines for qualification by analysis
[AD- 49]	ITER_D_WDBC7H	List of manufacturing documents to be prepared and stored for PE and NPE
[AD- 50]	ITER_D_QVEKNQ	Release Note Template
[AD- 51]	ITER_D_355QX2	IO cable catalogue
[AD- 52]	ITER_D_2EB9VT	EDH Guide A: Electrical Installations for SSEN Client Systems
[AD- 53]	ITER_D_22MAL7	Procedure for Analyses and Calculations
Applicable Regulatory Documents		
[ARD- 1]	PED/ESP	European Pressure Equipment Directive 2014/68/EU of 15th of May 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment

[ARD- 2]	ESPN	Order dated 30th of December 2015 on nuclear pressure equipment. Consolidated version after the 1st of January 2019 shall be taken into account.
[ARD- 3]	INB Order	Order dated 7 February 2012 relating to the general technical regulations applicable to INB

5 SCOPE OF WORK

The contractor is responsible for all necessary design development, qualification and manufacturing activities to deliver **two** Vacuum Vessel Pressure Suppression System Gas Heaters that meet all applicable requirements. The VVPSS Gas Heaters are components of the ITER Vacuum Vessel Pressure Suppression System (VVPSS) and provide heating to 500 Nm³/h of high-humidity air, up to 50°C, to enhance the subsequent catalytic hydrogen recombination.

The heaters will be installed in series and each will independently meet the full heating requirement for redundancy.



The activities are divided into the following tasks:

- **Task 1: Design & Structural Integrity Verification:** Develop a detailed design of the Heaters for manufacturing. Submit all geometry data, models and drawings required for the integration of the equipment into the VVPSS CAD model. Provide all mandatory qualification documentation needed for the Final Design Review.
- **Task 2: Manufacturing:** Manufacture the Heaters in line with the applicable requirements.
- **Task 3: Inspection, Examination and Factory Acceptance Tests:** Perform all necessary inspections, examinations and testing required by the design code and technical specification.
- **Task 4: Delivery to IO site:** Design, analyse, and manufacture a suitable transport package for the Gas Heaters. Clean and prepare the equipment for transport. Prepare and hand over all documentation required by this technical specification.

Note, Task 2 can only begin after the approval of the internal ITER design gate. The contract will be put on hold after completing Task 1 until the ITER Final Design Review is completed. The target timeframe for the VVPSS Final Design Review is set from Q1 to Q3 of 2026.

5.1 MAIN FUNCTION AND BOUNDARIES

The main functions of the VVPSS Gas Heaters can be summarised as follows:

1. To heat the Hydrogen Mitigation System (HMS) gas entering the Catalytic Hydrogen Oxidation Reactor;
2. To ensure confinement of the radioactive inventory.

Boundaries of jurisdiction shall be the equipment end connections (e.g. connecting flanges, welded-end connections), where the heater's pressure boundary connects to the adjoining VVPSS piping.

6 TECHNICAL REQUIREMENTS

6.1 DECLARATION OF CONFORMITY TO PED – ESPN REGULATIONS

The VVPSS heaters shall be considered pressure accessories and shall be assessed for their conformity to PED/ESPN rules before being sent to IO.

	Safety class	Quality class	Seismic class	Vacuum class	Tritium class	PED Fluid type	PED category	ESPN level
VVPSS Heater	PIC	QC-1	SC-1 (SF) SL-2	No-VQC	TC-2A	Gas - I	II	N2

In accordance with the ESPN N2 classification, the Contractor shall appoint an Agreed Notified Body (ANB) to carry out the conformity assessment under the selected module. A Declaration of Conformity shall be issued, confirming that the Gas Heaters meet the Essential Safety Requirements of the ESPN Order [ARD- 2].

The Contractor is responsible for selecting the appropriate conformity assessment module during the procurement phase. While this choice depends on the equipment's level, risk category and nature, IO recommends modules B+F or G for Contractors new to ESPN, and modules H or H1 for those with prior experience and relevant certifications.

For ESPN compliance, critical pressure part sizing must consider worst-case tolerance scenarios. Contractors should also prepare a comprehensive documentation package, aligned with [ARD- 1] and [ARD- 2], to properly assess the additional work required for the ESPN conformity assessment.

As QC-1 components, the critical quality activities must be approved by IO before being undertaken. Throughout the document, special processes are identified. These special processes will require their procedures to be submitted to IO and accepted before their undertaking and reports submitted in the manufacturing dossier.

6.2 DESIGN CODES

The final heaters should be designed and manufactured by EN standards. In addition to EN standards, the Contractor may use another design code to meet the requirement.

The choice of code is at the discretion of the Contractor. However, if the Contractor selects a non-PED/ESPN harmonised standard, it is the Contractor's responsibility to demonstrate the compliance of the selected design code with the PED/ESPN Essential Safety Requirements.

6.3 DESIGN PARAMETERS

Parameter	Unit	Value
Fluid	-	97% Air @ 100% RH 3% Hydrogen
Operating gas flow rate	Nm^3/h	500
Maximum gas flow rate	Nm^3/h	550
Minimum gas flow rate	Nm^3/h	350
Operating Pressure	bar(a)	0.75
Minimum Inlet Temperature (TS_min)	°C	6
Operating Outlet Temperature	°C	50
Maximum Operating Temperature (TS_max)	°C	130
Maximum Allowable Pressure (PS)	bar(g)	9
Allowable Pressure Drop per unit	Pa	500
Maximum Power per unit	kW	10
Dimensions per unit	m	Length: 1 Width: 0.4 – excluding electrical connections

6.4 ELECTRICAL AND CONTROL CABINET

Each Heater will be powered by 400 VAC, 3-Phase, 50 Hz power from a four (4) wire (3-phase, neutral system plus an earthing connection. The power feeder cabinets and their locations are listed below.

Heater	Electrical cabinet		Type of feeder	Control cabinet	
	Cabinet tag	Location		Cabinet tag	Location
24VPHM-HT-1060	24VPHM-CMC-1000	11-L5-04N	SSEN	48012A-CU-0040	11-L5-04N
24VPHM-HT-1160	24VPHM-CMC-1100	11-B2-04SE	SSEN	48012B-CU-0087	11-B2-05SE

- Heater temperature control shall be implemented by on-off control. The Contractor shall supply all control and protection components (like MCCB, power contactor, etc.) for each heater feeder, which will be kept inside the respective IO electrical cabinet. ITER has made a standardisation of these components, as indicated in [AD- 52].

Note, for FAT and qualification activities, the Contractor shall arrange a temporary and representative electrical & control cabinet, matching the IO configuration.

6.5 CABLES

The overall distance from the VVPSS Heater and the cubicle will be about 170 m.

The procurement of the cables for the final installation will be in the scope of IO. IO has a standard catalogue of cables designed for the conditions and requirements of ITER, as provided in [AD- 51].

- The Contractor shall provide the power cable sizing calculation.
- The Contractor shall identify suitable cable from the catalogue and provide their recommendations accordingly to IO during the supply of the items.
- However, if specialised cables are required which are not available in the catalogue, then the contractor shall specify the same in their technical submission to IO.
- The Contractor shall provide appropriate cable connectors and bushings that meet IO requirements.

Note, the Contractor is required to ensure that IO-qualified cables, or their equivalents when appropriately justified, are utilised during qualification and FAT activities. For FAT and qualification activities, the Contractor is responsible for making the necessary purchases.

6.6 TEMPERATURE SENSORS

Note, The sensor is classified as a Safety Accessory only if the Contractor is unable to demonstrate that a sensor malfunction will not result in exceeding TS_Max. *If classified as a Safety Accessory, a separate conformity assessment is required.*

- The Contractor shall provide temperature monitoring and high limit/control at the heater outlet.
- The transmitter is not part of the Contractor's scope of work. An IO-qualified transmitter will be chosen if needed.
- The temperature sensors shall be part of the qualification, as described in Section 6.8.2.
- The temperature sensors on each heater will terminate in the respective IO safety control cubicle.

6.7 RELEVANT VVPSS LOAD SPECIFICATION

For components classified as Protection Important (PIC), qualification is carried out taking into account all accidental events.

Load Case	Internal Pressure [bara]	External Pressure [bara]	Temperature [°C]	Service Level
Hydrostatic test	PS*1.5	Ambient	Ambient	A

Design conditions (PS, TS)	PS	Ambient	TS_max	A
External DTR accident	1	2	TS_max	A
Fire in DTR	1	1.5	277	C
Normal Operation+SMHV	1	Ambient	Ambient	A
Normal Operation+SL-2	1	Ambient	Ambient	A

6.8 QUALIFICATION OF ITER PROTECTION IMPORTANT COMPONENTS

This contract includes the complete qualification of the equipment for both normal and accidental conditions. The Contractor shall perform Structural Integrity Analysis for pressure, temperature, interface and seismic loading conditions.

As stated in [AD- 22], this procedure applies to all active and passive PICs.

Equipment shall be qualified according to the following methods:

- Qualification by testing;
- Qualification by analysis (analogy/extension/similarity, calculation, FEM);
- Qualification by the combination of both above methods.

Note, the Contractor is invited to provide information regarding its qualification experience and capabilities during the bidding process.

As a general rule, the qualification should be performed considering the last day of ITER operation life when the PIC equipment is aged. If the effects of ageing are demonstrated to be negligible, the ageing test could be avoided.

It is the responsibility of the IO to provide the Contractor with all the design input data.

Table 2 provides the qualification documents maturity at the end of the design phases.

The Contractor is obligated to deliver successful results from the qualification process to IO. If testing fails or if the Contractor does not meet IO's requirements, resulting in the need to repeat tests, this shall not entitle the Contractor to make any financial claims.

Table 2, Qualification documents maturity

Output	Final Design Review	Manufacturing Readiness Review, see 6.17
List of equipment to be qualified	Complete	
Identification File	Preliminary	Complete
Qualification plan	Preliminary	Complete
Qualification Test Specifications		Complete
Qualification Test Report		Complete
Qualification Analysis Report		Complete
Qualification Synthesis Report		Complete
Qualification Preservation Sheet		Complete
Reference file		Complete

Once the design input data are submitted, the Contractor, as Equipment Qualification Performer, shall follow the steps provided in Figure 1.

6.8.1 Qualification of ITER Mechanical Components

Guidelines for the qualification of ITER mechanical components are available in [AD- 23].

Note, IO recommends the use of RCC-M, Volume Q [AD- 2] *to complement what is indicated in* [AD-23].

6.8.2 Qualification of ITER Electrical and I&C Components

Guidelines for the qualification of ITER electrical and I&C components are available in [AD- 24].

Note, IO recommends the use of RCC-E [AD- 3] *to complement what is indicated in* [AD- 24].

The Contractor shall note that gas heaters and temperature sensors are classified as Type 1 – Simple Electrical Devices; however, regardless of the type of device qualification is based on three assessments [AD- 25]:

- Functional assessment
- Quality assurance assessment
- Environmental qualification assessment

The associated components or interface components shall be part of the qualification scope.

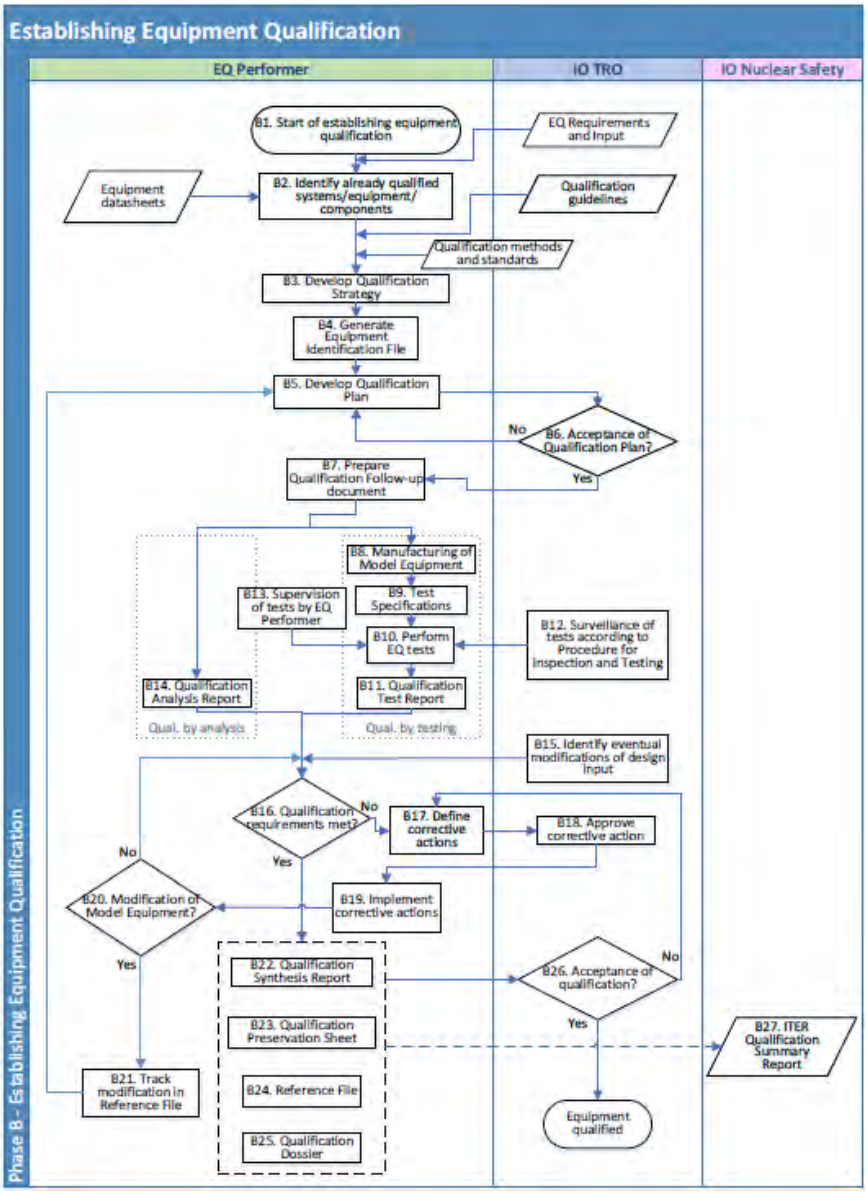


Figure 1, Equipment Qualification Roadmap

6.9 LIFETIME

Equipment shall have a design life of 25 years, excluding items such as gaskets.

From a qualification perspective, the lifetime starts at the end of manufacturing and so the duration spent in the warehouse and installation can be considered as follows:

- Storage at the ITER warehouse: up to 3 years – equipment in standby - not energised, not operated. Storage Level C is considered.
- Installation: up to 2 years – equipment in standby (not energised, not operated).
- Operation: up to 20 years.

State	Storage - Level C	Installation	Operation
External Pressure	Atmospheric pressure		As per Section 6.7
Internal Pressure			
Temperature	-8°C to +40°C indoor, no temperature control		
Humidity	0 to 100% (not controlled)		
Electromagnetic field	N/A		
Seismic	As per Section 6.7		
Fire	As per Section 6.7		

6.9.1 Ageing

If the Contractor demonstrates that effects of ageing are negligible, the ageing test could be avoided. The ageing of VVPSS heaters is only partially addressed in this technical specification for the following reasons:

- Heaters are located in the ITER B11 facility, which maintains a controlled temperature and humidity environment.
- The VVPSS system experiences only low levels of vibration, typical of a standard industrial environment.
- While VVPSS heaters are exposed to irradiation during ITER plasma operation, irradiation qualification is only required for items that may degrade under gamma radiation and neutron fluxes. Irradiation qualification is also necessary when electronic devices are included.

6.10 GEOMETRICAL FEATURES

The heaters will be incorporated into a DN150 piping arrangement, designed according to EN13480 [AD- 1].

6.10.1 Insulation

- The heaters shall be thermally insulated on their external surfaces to limit heat gain from the environment to the walls as well as act as a vapour barrier, protecting the walls from external condensation.
- The insulation shall be a minimum of 25 mm thick and have a thermal conductivity less than or equal to 0.05 W/m.K at 25°C. The Contractor shall demonstrate that the thickness of the insulation is enough to ensure integrity under fire load, see Section 6.11.2.2.
- The insulation and cladding system shall be easily removable to enable inspection of the outer surface of the vessels.

6.11 STRUCTURAL INTEGRITY ANALYSIS

Structural integrity analyses are considered “Special Processes”.

- Analysis reports shall be produced according to the template for the ITER Structural Analysis Report [AD- 37].

6.11.1 Stress Analysis

- The Contractor shall demonstrate the structural integrity of the pressure confinement boundaries by using the structural analysis to verify that the components can withstand all identified loads to the required service level. The structural analysis shall be undertaken in compliance with Instructions for Structural Analyses [AD- 27] and the IO procedures for analysis and calculations [AD- 53].
- The analysis shall include stress calculations, which can be performed analytically or via FEM, using ANSYS or ABACUS software and complying with the Software Qualification Policy [AD-26]. All files in ANSYS or other software to make a calculation shall be submitted to IO.

6.11.2 Environmental Qualification

Table 3: Environmental conditions applicable in the field (process area) in 11-B2-01 & 11-B1-01 Drain Tank Room (DTR)

	Normal condition	Accident condition
Ambient room temperature	18 ℃ – 35 ℃	5 ℃ - 130 ℃
Ambient room humidity	20% RH – 60% RH	0% RH – 100%
Ambient room pressure	86 – 106 kPa (a)	100 – 200 kPa (a)
Static magnetic field (modulus)	< 20 mT	
Transient magnetic field (modulus)	< 3.5 mT/s	
Total Ionising dose (TID, silicon-based)	< 2.3E3 Gy	
Dose rate (ionising radiation dose, silicon-based)	< 1.0 Gy/h	
Equivalent Neutron Fluence (ENF @ 1Mev, silicon based)	≤ 4.2E18 neutron.cm^{-2}	
Total Neutron Flux (TNF)	≤ 2.4E5 neutrons.cm^{-2}.s^{-1}	
Seismic	NO	YES, structural integrity during SL2
Flooding - submergence	NO	NO
Fire	NO	277°C

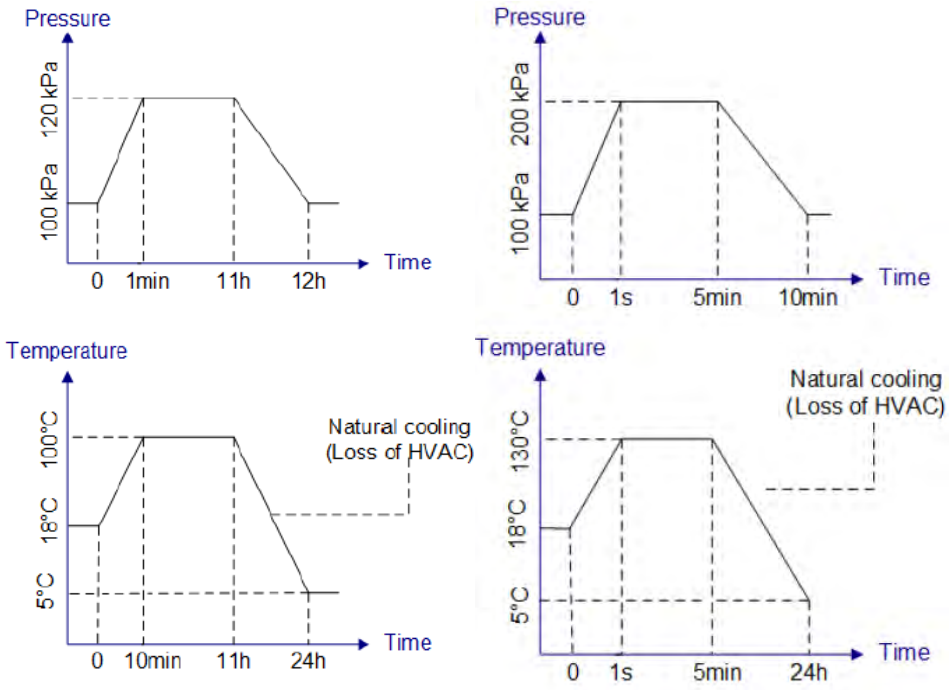


Figure 2, pressure and temperature profiles for a small/large LOCA in DTR[1]

6.11.2.1 Electromagnetic Field

The tests should be conducted according to the ITER test method [AD- 31].

[1]Given that the P/T profiles shown in Figure 2 may change, it is recommended to obtain IO validation of these profiles prior to initiating any qualification campaign.

- The contractor shall demonstrate that the electromagnetic field doesn't influence the performance of the system. In case of difficulty to demonstrate the effect of the magnetic field by qualification, the contractor shall provide literary evidence of the impact of the magnetic field on devices employing similar technology, where it is unambiguously proved that the magnetic field would not affect the item.

ITER has a Static Magnetic Field (SMF) testing facility at the ITER headquarters. On request of the contractor, arrangements can be made to test the device and qualify it for magnetic fields. The contractor shall clearly state the approach selected by them in their technical submission to this contract for IO to evaluate.

The Contractor should assess the impact of the static magnetic field on the operability of the heaters procured. As a general remark, IO recalls that the static magnetic field applied for the qualification test shall be between 1.4 and 2.0 times higher than the one experienced by the equipment during operation.

6.11.2.2 Fire

- The contractor shall guarantee the structural integrity of PIC components during and after a fire accident for a minimum of 2 hours. Integrity is demonstrated with no external leaks after a fire event.

6.11.2.3 Irradiation

The VVPSS heaters are subjected to irradiation during ITER plasma operation.

- The contractor shall demonstrate that radiation ageing effects are negligeable for all the parts sensitive to aging that could affect the safety function. The doses provided by IO shall be used as input for the development of the Maintenance Plan, as it is part of the input data needed from ESPN point of view.
- The contractor shall assess as a minimum the non-metallic parts (e.g. polymeric materials), electronics parts (parts containing silicon, transistors, semiconductors and integrated circuits).
- The irradiation test shall be performed before accidental tests.

6.11.3 Seismic Qualification

It is recommended that the Contractor provides since the beginning a detailed quotation and planning of the activities that consider the selected seismic qualification.

- The VVPSS heaters shall be capable of withstanding the accelerations associated with the seismic events without loss of functional performance or confinement.
- SC-1 (SF) means that structural stability/integrity and operability shall be maintained during an earthquake. The Contractor shall demonstrate that the Heaters can achieve the normal operation functionality following an SMHV (Maximum historical probable earthquakes) event and SL2 seismic events.

The methodology for seismic qualification can be obtained from the guidelines for qualification by analysis [AD- 28] and the ITER Instruction for Seismic Analysis [AD- 29]. The methodology for performing seismic qualification by testing can be obtained from [AD- 30].

Qualification to seismic resistance can be performed by tests, analysis or mixed/combined methods.

Appendix 1 provides the Contractor with the Floor Response Spectrum.

6.11.3.1 Seismic Qualification Test Sequence

The seismic qualification tests, applicable only to those extended structures for which the analytical qualification is deemed not sufficient, shall be performed according to the standard IEC/IEEE 60980-344 Nuclear facilities – Equipment important to safety – Seismic qualification [AD- 4].

The seismic tests will have to be implemented after ageing preparation and tests.

6.11.3.2 Acceptance Criteria

Structural Integrity	Leak Tightness	Operability
No broken parts, no deformation.	No leaks out of the pressure boundary. Connections are maintained after the earthquake.	Gas flow normally Heaters work normally

6.12 MATERIALS

The material selected for the heaters is 304L Austenitic Stainless Steel.

Materials		
Cast items	ASTM A351 CF3	EN 10213 Grade GX2CrNi19-11 (1.4306)
Forged items	ASTM A182 F304L	EN 10222-5 Grade X2CrNi18-9 (1.4307)
Items fabricated from plate material	ASTM A240/A240M	EN 10088-2 Grade X2CrNi18-9 (1.4307)

- Any deviation from this material shall be agreed with IO and, in any case, compatible with the VVPSS piping assembly, which is ASTM A312M, grade TP304L.
- To ensure the VVPSS meets the radioprotection guidelines as stipulated in the Radioprotection Guide for ESPN Application [AD- 32], strict requirements are placed on the chemical composition of Cobalt, Niobium, and Tantalum. Strict requirements are placed on the composition of Boron to prevent adverse effects on weldability.

As a general remark, it is important to highlight the fact that the requirements for the chemical composition of Cobalt, Niobium, and Tantalum apply to all components and not only to the "wet parts".

Table 4 sets additional requirements for the impurities' maximum concentration.

Table 4, Impurities maximum compositions .

Composition, % (maximum, unless otherwise indicated)		
Co	Nb	Ta
< 0.2	< 0.1	< 0.1

NOTE, IO may consider deviation from this requirement where the Contractor can demonstrate the component to have a small mass (i.e. bolts, nuts, washers, etc.) and the cost of achieving the above low activation requirements would be excessive compared to the decreased in overall cobalt, niobium or tantalum. No deviation is allowed on large items.

6.13 PROHIBITED MATERIALS

- The Contractor shall be aware of the following requirements, related to the prohibited materials:
  - Mercury shall not be used in any manner, including the construction of the components, which can result in the exposure of cooler parts to the metal or its vapour.
  - The use of lead or other low melting point metals in contact with the working fluid is prohibited.
  - The use of nitrided surfaces exposed to the working fluid is prohibited.
  - Care shall be taken to prevent contamination of materials by red lead-graphite-mineral oil, molybdenum disulphide lubricants, halides, sulphur, copper, zinc and phosphorus.
  - Teflon and similar elastomers may not be used.
  - The use of Halogen products is prohibited. This requirement applies to all components, including gaskets and other non-metallic materials. Any deviation from non-zero halogen content in any of the materials used shall be reported to IO and its use shall be subjected to IO approval.
  - The use of materials containing asbestos shall be prohibited.
- The Contractor shall ensure that all stainless-steel material covered by this specification does not come into contact with any other metals (especially carbon steel), at any stage of the whole manufacturing process (in particular during raw material storage, manufacturing itself, final product storage) and shipping as well, by ensuring a proper segregation from non stainless-steel material. The purpose is to avoid cross-contamination of stainless steel with other metallic products. In case of proven contamination of stainless steel by carbon steel, the Contractor shall perform pickling and passivation of the contaminated material. Pickling and Passivation shall be considered as a "special process".

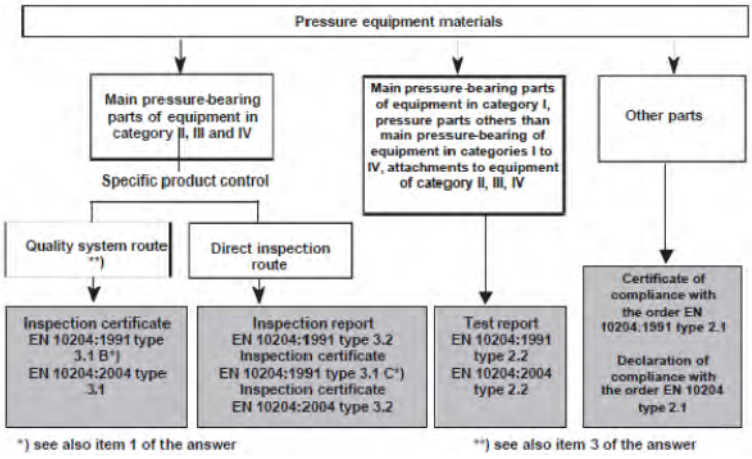
6.14 TESTING REQUIREMENTS

- As part of the conformity assessment, the Contractor shall provide a Nuclear Particular Material Appraisal, as defined in [ARD- 2]. This document shall address those testing requirements defined by the PED and ESPN Essential Safety Requirements as well as those defined by the design code selected.

NOTE, as per PED Essential Safety Requirements, the Offset Yield Point (Proof Stress) shall be evaluated at 0.2% and 1% plastic deformation.

- Certificates (test reports) showing that required tests have been carried out at the source should be submitted. Type 3.1 certificate of EN 10204 [AD- 5] shall be provided for main pressure-retaining materials. The chemical Co, Nb and Ta concentration evaluation shall be included as a result in the Type 3.1 certificate. If the impurities maximum concentration test is performed separately, the Agreed Notified Body shall be involved in this process to confirm the test results.
- **A second material testing certificate, submitted by an independent certified laboratory, shall be included in the list of documentation submitted to the Contractor, after the placement of the supply order.**
- Inspection Certificate Type 3.2 must be provided by the Contractor when material manufacturer does not have a Quality Assurance System in line with the requirements of PED Annex I 4.3 and ISO 9001. The certificate can be provided by the Contractor provided there is justification from the competent bodies following material testing.
- Materials shall be clearly marked so that they are always readily identifiable with their test certificates and reports. Marking shall be transferred to all pieces when a part is cut to make more than one component. Material without identification shall not be used in the manufacture. The method of marking and marking procedures are subject to IO acceptance.

Note, Considering the function of gaskets, inspection documents should be the type 2.2 [AD- 5]*. As the gasket is not the main pressure-bearing part of the equipment, it is not necessary to have type 3.1 or 3.2 in terms of this regulatory framework.*



6.14.1 Impact and Tensile Test

- Mechanical properties shall be obtained from test specimens that represent the final heat-treated condition of the material required by the material specification. The tensile test shall be carried out at all operating temperatures, up to the design temperature.
- The impact test shall be performed at a temperature not greater than 20°C but not higher than the minimum TS.

Table 5, Acceptance criteria for the Impact and Tensile Test [ARD- 2]

Type	Material structure	A @ RT	KV
Base metal	Ferritic	A ≥ 14%	KV ≥ 27J @0°C
	Austenitic	A ≥ 25%	KV ≥ 60J @20°C
		A ≥ 45%	No KV required
Deposited metal (weld)	Austenitic	A ≥ 25%	KV ≥ 50J @20°C for test coupon
Bolting	Ferritic	A ≥ 12%	KV ≥ 40J @0°C

		12%≤A ≤ 14%	KV ≥ 40J @0°C & Reduction in area ≥ 0.45
	Austenitic	A ≥ 12%	KV ≥ 40J @0°C or KV ≥ 50J @RT
		12%≤A ≤ 14%	KV ≥ 40J @0°C or KV ≥ 50J @RT & Reduction in area ≥ 0.45

- All tests shall be carried out by an ISO 17025 [AD- 6] accredited laboratory.

6.14.2 Sensitization

- The contractor must ensure that intergranular corrosion is completely avoided. The Contractor shall perform at least ASTM A262, Practice A, E and finally provide a detailed view of microstructures with SEM observations.

6.15 FLANGED CONNECTION

Above all other requirements of this technical specification, the Contractor shall ensure that the flanged connections comply with the leak-tightness requirements.

- For the preparation of flanged ends with flange facing, nut-bearing surfaces, outside diameter, thickness, and drilling, IO recommends the use of EN 1092 [AD- 7]. It is the responsibility of the Contractor to provide the pressure class of the selected flanges, based on the Maximum Allowable Pressure (PS) and Maximum Allowable temperature (TS).
- Flanges furnished with tapped holes shall provide full effective thread engagement, not including the chamfered thread, for a length at least equal to the nominal diameter of the bolt thread.
- Flanged ends shall be prepared with flange facing, nut-bearing surfaces, outside diameter, thickness, and drilling by EN 1092-1.
- Items supplied with flanged ends shall be provided with adequate bolts, nuts, washers, and gaskets as described below:
  - Bolts: Bolting for the flanged connections shall be supplied with each flange and should conform to EN 1515 [AD- 8]. The material selection shall be based on the assembly requirements to achieve leak tightness. The Contractor shall calculate the bolt torques to provide proper assembly.
  - Nuts: Nuts for the flanged connections shall be supplied with each flange and should conform to EN 1515.
  - Washers: Washers (lock or Belleville) shall be supplied with each flanged connection, as described in ASME B18.21.1 [AD- 9].
  - Gaskets: Gaskets shall be supplied with each flange. The gaskets should conform to EN 1591 [AD- 10] to ensure compliance with leak tightness requirements, as defined in Section 6.19.1.
    - The Contractor shall be able to identify minimum gasket compression stress for assembly (Qa), testing (Qmin) and operation/accidents (Qsmin).

6.16 WELDED JOINTS OR PERMANENT JOINTS

Welding activities are considered “Special Processes”.

NOTE, permanent joints, other than welds, shall follow the equivalent requirements described in this section.

- Each welding procedure that is to be followed in fabrication shall be included or cross-referenced in the Manufacturing and Inspection Plan (MIP) and weld map. Additionally, the procedures shall be included in the Weld Data Package.
- All pressure-bearing joints shall be full penetration butt-welded. No threaded joints or socket welds shall be used.
- The pressure-bearing welded/permanent joints shall permit volumetric NDT.
- All repairs, rework, or scrapping shall be documented and records maintained for each specific item. The records shall relate repairs to the procedure used. A maximum of one weld repair cycle shall be permitted on austenitic stainless steel. The IO shall be notified in the event the weld repair is unsuccessful.
- Production welding operations may only be undertaken provided the following requirements are met:

- Personnel satisfy the requirements of EN 13480-4 (Section 9.1) and EN 3834-2 [AD-11];
- The filler materials shall have Inspection Certificate type 2.2 as per EN 10204 [AD- 5];
- Welding procedures have been qualified in accordance with EN 15614-1 [AD- 12];
- All the welds shall be identified with a unique number and shall be traceable back to the welder/operator and WPS used;
- Any visible defect liable to affect the correct execution of the next pass shall be removed.
- Cracks or cavities visible on the surface shall be removed by chipping, grinding, and/or milling.

- The welding procedure qualification record and welder shall be approved by the Notified Body or RTPO when it is classified as a pressure-bearing weld, as per Article R. 557-4-2, §11 a) i or ii.

6.16.1 Preparation for Welding

- Preparation of welding should comply with ISO 9692 [AD- 13].
- The edges to be welded shall be kept in the position, either by mechanical means, temporary attachments, by tack welding or by a combination.
- This cleaning of internal and external surfaces should conform to EN 2516 [AD- 14]. The surface within 50mm from the area of the weld shall be smooth, free from cracks, fins, tears and other discontinuities, which would affect the quality of the welding.

6.16.2 Surface Preparation Requirements

- Surface roughness (Ra) shall not exceed 6.3 µm.

6.17 MANUFACTURING READINESS REVIEW

- Following the approval of the MIP, a Manufacturing Readiness Review (MRR) shall be conducted by IO, in line with [AD- 33], and closed before the start of manufacturing activities. This MRR shall be included on the MIP as a Hold Point.

The MRR is a joint ITER-Contractor meeting to give approval for the Contractor to start manufacturing. For the final approval, the following documentation shall be presented:

- Procedures for special processes;
- All manufacturing drawings;
- Material test certificates;
- Engineering (Structural) analysis;
- Personnel qualification;
- Qualification plan;
- Qualification Synthesis Report;
- Qualification Preservation Sheet;
- Reference file.

6.18 MANUFACTURING INSPECTION AND TESTING

- Inspection, examinations and tests shall be conducted to provide compliance with PED/ESPN Essential Safety Requirements.
- The Contractor shall prepare a Manufacturing and Inspection Plan that meets the requirements of ITER MIP [AD- 34]**.** All testing shall be recorded as required by the referred standard for the relevant testing method. If testing is not recordable, the testing quality shall be ensured by quality control of the testing process.

Note, the MIP is a listing of the chronological sequence of manufacturing operations affecting quality encompassing the whole scope of the subcontract and ranging from verification of materials, manufacture, inspection and test to delivery. For PIC elements, the MIP also clearly identifies the PIA. It will be used to monitor quality control and acceptance tests.

- Before Manufacturing operations, the MIP shall be generated by the procedure provided in Section 4 of [AD- 34].

- Non-destructive examinations shall be performed after heat treatment in agreement with PED and ESPN regulations. Surfaces shall be clean and free of surface conditions that may mask unacceptable indications.
- Examination personnel shall be qualified and certified by ISO 9712 [AD- 15] and shall be approved by the RTPO.

Note, IO reserves the right to inspect all Non-Destructive Examination (NDE) reports for auditing purposes.

6.18.1 Visual examination

Visual examination is considered a “Special Process”.

- All finished welds shall be subject to visual examination.
- Visual and dimensional control shall be conducted according to EN 17637 [AD- 16] before the execution of non-destructive examination after possible heat treatment and before any machining or grinding operations of weld surfaces.
- During welding, each pass shall be visually examined, after the complete removal of the slag, if necessary.
- A complete visual inspection of the pressure boundary parts is required before final assembly and on accessible pressure boundary parts without disassembly after hydrostatic testing. The purpose of the visual inspection is to verify all surfaces are free of cracks, hot tears, arc strikes, prod marks and/or other detrimental discontinuities.

6.18.2 Volumetric examination

- For PED/ESPN components, the rules of EN13445-5 applies.
- The Contractor may choose Radiography or Ultrasonic inspection as appropriate.

6.18.2.1 Radiography Inspection

Radiography examination is considered a “Special Process”.

- IO recommends the use of EN 17636 [AD- 16] and ISO 10675-1 [AD- 17] for the radiographic procedures and acceptance criteria.

6.18.2.2 Ultrasonic Inspection

Ultrasonic examination is considered a “Special Process”.

- IO recommends the use of EN 11666 [AD- 18] and EN 17640 [AD- 19] for the ultrasonic examination of casting products.

6.18.3 Surface Examination

- All exterior and all accessible interior surfaces shall be examined. The Contractor will provide a detailed description of the surface examination method selected.

6.18.4 Wall Thickness Measurements

Dimensional inspection is considered a “Special Process”.

- The wall thickness of the pressure boundary shall be measured. The Contractor shall ensure that the sizing of critical pressure parts takes into account the worst-case tolerance analysis.
- The Contractor shall take several measurements and record the location of the measurements on the drawings.

6.18.5 Acceptance Criteria

The acceptance criteria shall meet the requirements of EN ISO 17635.

6.19 FACTORY ACCEPTANCE TESTING

The Contractor shall perform the functional and leak tests of the heaters for normal operating conditions, according to Section 6.3. FAT shall include as a minimum:

  - Assembly leak test;
  - Functional test.
- The Contractor shall provide a report for each test and demonstrate compliance with the requirements specified in this technical specification. This program shall provide documented evidence that the equipment is able to fulfil its safety functions in all postulated normal and accidental conditions in which it is required and during the required operating period.

6.19.1 Assembly (External) Leak Test

- The Contractor shall ensure that the total leak rate does not exceed 10^{-5} $Pa.m^3.s^{-1}$ at design conditions.

6.19.2 Functional Test

The gas heating testing is considered a “Special Process”.

- The heater must be capable of heating the gas at the specified gas flow rates.

6.20 FINAL ASSESSMENT PROCEDURE

As part of the PED/ESPN conformity assessment, the following sequence of actions shall be performed and recorded:

- Document check;
- Visual examination before the pressure test;
- Pressure test;
- Final visual examination after the pressure test.

6.20.1 Pressure Test

Pressure testing is considered a “Special Process”.

- The pressure test shall be carried out according to Section 9.3 of EN 13480-5 [AD- 1].
- The parts operated under pressure shall be pressure tested. Testing may be done in the component or assembled conditions. All process volumes shall be connected to provide equal pressure. These tests shall be conducted after all machining and welding operations on the parts have been completed. The Contractor shall prepare and submit the pressure test procedures for the IO review and approval.
- The minimum test pressure shall conform to the PED Annex I, 7.4 [ARD- 1].
- All joints, including welds, shall be left uninsulated and exposed for examination during the test.
- The hydrostatic test pressure shall be maintained for at least 30 minutes.

6.21 IN-SERVICE INSPECTION AND MAINTENANCE

The Heater is accessible only during the long-term maintenance period, which occurs at the end of an 18-month operational period. Therefore, the Heater system must operate reliably without needing maintenance for at least 18 months.

- The manufacturer shall specify the maintenance requirements of the proposed sensor while quoting for the tender.
- The operator shall be able to inspect all internal and external surfaces of the heaters.
- The scope of this specification includes technical field support and consultation services during the installation, initial operation of all equipment furnished, performance testing and training of IO operating and maintenance personnel.
- The Contractor shall include in the operation and maintenance manual instructions on how the internal and external inspections can be undertaken. Any tools required to perform the above inspections shall be included in the scope of supply of this contract (excluding cameras or endoscopes).

6.22 PACKAGING AND HANDLING

- The Contractor shall provide a transport package for the heaters, adequate to prevent damage during shipping lifting and handling operations.
- Before packaging, the Contractor shall prepare a manufacturing and qualification dossier as well as a Contractor Release Note (CRN) in accordance with [AD- 34] using template [AD- 50] and submit it to the IO for review and approval.
- Where appropriate, accelerometers or other sensors shall be fitted to ensure that limits have not been exceeded. When accelerometers are used, they shall be fixed onto each box and shall be capable of recording the acceleration along three perpendicular directions.
- Shock-absorbing material shall be used.
- All the flanges shall be fitted with caps after final testing.

- The heaters have to be wrapped in plastic covers to protect them during final storage and transportation. The use of adhesive tape for detection and packaging shall be restricted to prevent the risk of contamination from the tape. In particular, tape used on austenitic stainless steel shall meet leachable chloride and fluoride limits of 15 ppm and 10 ppm, respectively. Where used, tape shall be fully removable, leaving no residue, using isopropyl alcohol or acetone as the solvent to remove all traces of the adhesive.

7 LIST OF DELIVERABLES

7.1 WELD DOCUMENTATION REQUIREMENTS

The following welding documentation shall be retained in the Contractor's shop and available for IO review.

- Administrative procedures for the control of the welding program, which includes qualification of Welding Procedure Specifications, qualification and assignment of welders, filler metal control, the performance of post-weld heat treatment (PWHT), control of welding work, specification of workmanship requirements, and other information related to the administrative control of welding.
- Records of Welder Performance Qualification and updates/renewal of qualification for the welders who will be assigned to the work, according to EN 9606 [AD- 20]. Additional requirements of EN 13480-4 [AD- 1] section 9 shall be applied as well.

7.2 MANUFACTURING DOSSIER

All the following documents shall be submitted to IO for acceptance.

Contract Documentation

- Final technical specification;
- Quality Plan;
- NDT procedures/Inspection personnel certifications;
- Full supplier list;
- List of Welders – Certificates;
- List of documents.

Design Documentation

- List of standards used and solutions adopted to meet the applicable requirements;
- Preliminary Qualification Dossier
  - Qualification Strategy, using template [AD- 39];
  - Equipment Identification Files, using template [AD- 38];
  - Qualification Plan, using template [AD- 43].
- Structural analysis report;
- Special process procedures;
- Verification and validation of software documents;
- Assembly, 3D models (.stp files) and detail drawings;
- Bill of Materials;
- Manufacturing Inspection Plan;
- Hazard and Risk Analysis;
- Technical Note on the process and sizing calculations.

Material Documentation

- Material test reports;
- Material supplier's quality system certificate;
- Consumable list;
- Destructive test report;
- Nuclear Particular Material Appraisal.

Fabrication Documentation

- Weld maps and weld repair procedures (if applicable);
- Heat treatment report, including temperature measurement data;

- NDT reports;
- Surface roughness measurement report;
- Inspection report with complete dimensional and tolerance evaluation – technical note justifying thickness in the case of a design by calculation;
- As-built drawings;
- Approval of welding documentation by RTPO or NB;
- Certificate of cleanliness;
- List of special tools, if any.

Qualification and Procedure Documentation

- Permanent marking and labelling procedures;
- Qualifications of the personnel for manufacturing special processes;
- Qualification dossier, using template [AD- 40]
  - Surveillance of tests;
  - Identification and definition of corrective actions;
  - Qualification Test Specifications, using template [AD- 45].
  - Qualification Follow-Up, using template [AD- 41];
  - Qualification test reports, using template [AD- 47];
  - Qualification analysis reports, using template [AD- 48];
  - Qualification synthesis reports, using template [AD- 44];
  - Qualification preservation sheets, using template [AD- 42];
  - Reference file, using template [AD- 46].
- ESPN dossier, see [AD- 49];
- Deviation requests and non-conformity requests;
- Installation, operation and maintenance manual – Instruction manual, bilingual English and French.

Delivery Documentation

- Cleaning and packing report;
- Final inspection report;
- Delivery report;
- Packing list;
- Preservation manual;
- Contractor Release Note;
- Photographs of packaged components;
- Any document/drawing/procedure that needs prior approval by the IO as mentioned elsewhere in this specification;
- Manufacturer Declaration of Conformity.
- Certificate of Conformity, issued by the Notified Body.

7.3 LIST OF DELIVERABLES

Deliverable	Description	Estimated due date	Contract Gate?	Percentage of Payment
D1.1	Kick-off meeting minutes	T0 + 1 week	No	-
D1.2	Approval of documents related to the "**Contract documentation**" section	T0 + 1 month	No	-
Hold Point (T1)	Approval of all the qualification documents needed for the Final Design Review and Preliminary Qualification Dossier	T0 + 3 months	Yes	10%
Completion of Task 1				
D2.1	Approval of documents related to the "**Design documentation**"	T1 + 1 month	No	-

	section, excluding the Seismic analysis report			
D2.2	Approval of documents related to the "**Material documentation**" section	T1 + 2 months	No	-
Hold Point (T2)	Closure of the Manufacturing Readiness Review and approval of the Seismic analysis report. Approval of all the qualification documents needed for the MRR.	T1 + 2 months	Yes	20%
Completion of Task 2				
D3.1	Completion of the FAT	T2 + 6 months	No	-
D3.2	Approval of **Manufacturing Dossier**	T2 + 6 months	Yes	40%
Hold Point (T3)	Approval of the ESPN dossier, which enables the shipment of the equipment	T2 + 6 months	No	-
Completion of Task 3				
D4.1	IO acceptance of the delivered equipment	T2 + 7 months	Yes	30%
Completion of Task 4				

8 QUALITY ASSURANCE REQUIREMENTS

The Quality class under this contract is QC1.

[AD- 34] and [AD- 21] apply in line with the defined Quality Class.

9 SAFETY REQUIREMENTS

The scope under this contract covers PIC and/or PIA and/or PE/NPE components,[AD- 21] GM3S section 5.3 applies.

10 DELIVERY

- The transport of the components shall be the responsibility of the Contractor. The selection of the transport company shall be at the contractor's discretion and the Contractor shall be responsible for the transport to the delivery location.
- Before the shipment, a Release Note shall be prepared in accordance with [AD- 34] and approved by the IO. Additionally, a native file item-level packing list and a delivery report shall be provided to logistics.data@iter.org in accordance with the working instruction for the DRR [AD- 35], at least 15 working days before the planned shipment date for each shipment.
- Marking shall be transferred to all pieces when a part is cut to make more than one component. The method of marking and marking procedures shall comply with the document "ITER Numbering System for Components and Parts" [AD- 36]. IO will provide a detailed 'IO component identification standard' together with printed label (QR-code) templates.
- Shipment and Delivery will be undertaken using the International Commercial Terms (Incoterms) 2010. The Contractor shall deliver the equipment "Delivered At Place" (DAP) to the IO Site:

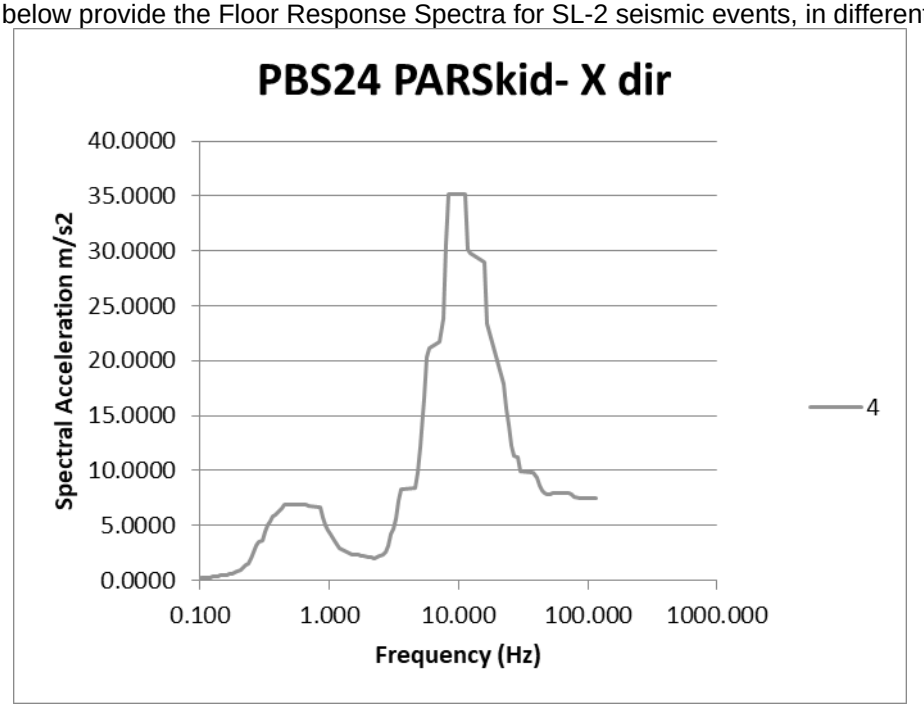
  ITER Organization,
  Route de Vinon-sur-Verdon
  CS 90 046
  13067 St Paul Lez Durance
  Cedex

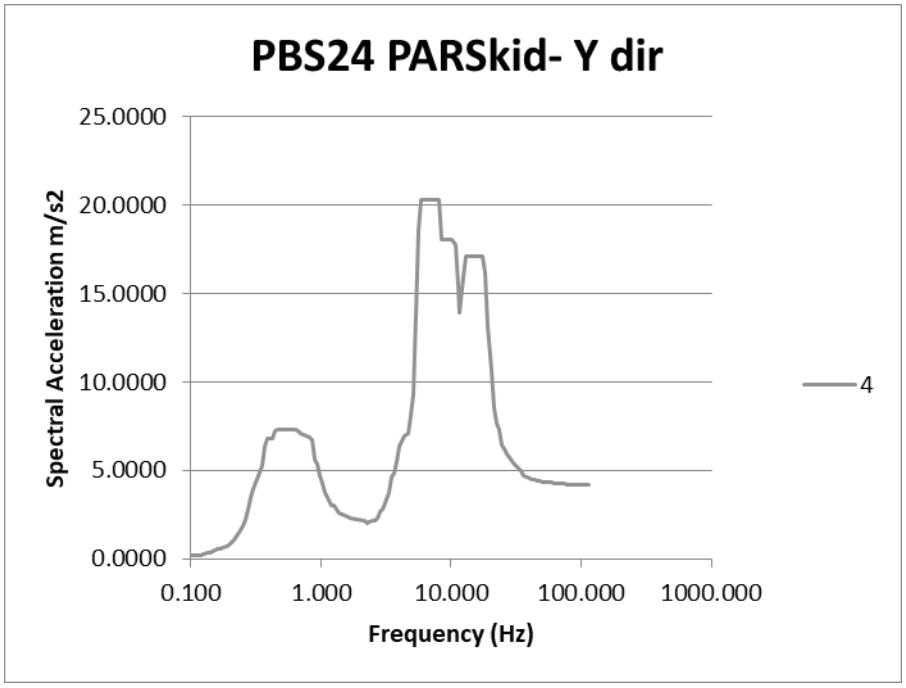
France

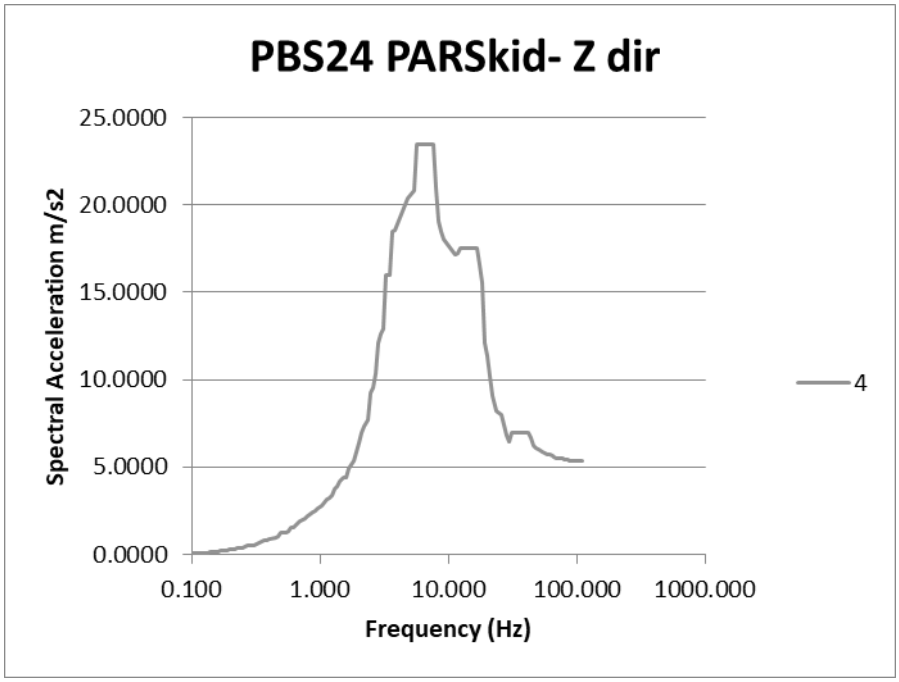
APPENDIX 1: FLOOR RESPONSE SPECTRA

ITEMS LOCATED IN THE DRAIN TANK ROOM (11-B1/B2-01)

The tables below provide the Floor Response Spectra for SL-2 seismic events, in different locations.






PBS24 PARSkid- Z dir
Spectral Acceleration m/s2
25.0000
20.0000
15.0000
10.0000
5.0000
0.0000
0.100
1.000
10.000
100.000
1000.000
Frequency (Hz)
4