外部委託業者の募集

References: IO/24/OT/10028547/YLI

"Design, Assembly, and Operation of Large-Scale Hydrogen-Qualified Laboratory for Testing ITER Prototype Catalytic Hydrogen Reactors "

（ITER 触媒水素反応炉プロトタイプを試験するための大規模水素適格研究室の設計、組立と運転）

IO 締め切り 2024 年 6 月 14 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。

本文書の目的は作業範囲と入札プロセスに関する技術的な内容の基本的な要約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

この公開入札の目的は、適切なパートナーを特定し、大規模な水素適格試験室を設計し、建設し、試運転し、運用できるパートナーを特定することです。この試験室の主な役割は、IOが開発した2つの触媒水素酸化プロトタイプ（CHOP）をテストして検証することです。

詳細については、添付の技術仕様AKHHRV_v1_0を参照下さい。

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。

  - 会社名
  - 登録の国名

- 担当者名、email アドレス、肩書および電話番号

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

  PIN の発行から 10 作業日経過後、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	2024 年 4 月 30 日
関心表明フォームの提出	2024 年 6 月 14 日
iPROC での入札への招待（ITT）の発行	2024 年 6 月 17 日
明確化のための質問の締め切り	2024 年 7 月 15 日
明確化のための質問への回答締め切り	2024 年 7 月 22 日
入札提出	2024 年 7 月 29 日

契約授与	2024 年 9 月
契約調印	2024 年 9 月

〇契約期間と実行

ITER機構は2024年の10月ごろ供給契約を授与する予定です。予想される契約期間は19か月の予定です。

〇経験

契約者は、IO の規則と安全性の要求に十分に準拠する能力と経験を持っていることを示す必要があります。

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「**Design, Assembly, and Operation of Large-Scale Hydrogen-Qualified Laboratory for Testing ITER Prototype Catalytic Hydrogen Reactors**」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/24/OT/ 10028547 /YLI

for

Design, Assembly, and Operation of Large-Scale Hydrogen-Qualified Laboratory for Testing ITER Prototype Catalytic Hydrogen Reactors

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 for the procurement of Design, Assembly, and Operation of Large-Scale Hydrogen-Qualified Laboratory for Testing ITER Prototype Catalytic Hydrogen Reactors.

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 Service 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 aim of this Open Tender Procurement is to identify a suitable partner who can design, build, commission, and operate a large-scale, hydrogen-qualified testing laboratory. The primary task of this laboratory will be to test and validate the two Catalytic Hydrogen Oxidation Prototypes (CHOPs) developed by IO.

For more details, please see attached Technical Summary AKHHRV_v1_0

4 Procurement Process & Objective

The objective is to award a Service 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" 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

After the deadline of expression of interest (as shown in the Procurement Time table) following the publication of the PIN, the Request for Proposals (RFP) will be published on our digital tool "Iproc". This stage allows interested bidders who have indicated their interest to the Procurement Officer 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

  A Service contract will be awarded on the basis of best value for money 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)	30/04/2024
Submission of expression of interest form	14/06/2024
Invitation to Tender (ITT) launched on iPROC	17/06/2024
Clarification Questions Deadline	15/07/2024
Clarification Response Deadline	22/07/2024
Tender Submission	29/07/2024
Contract Award	September/October 2024
Contract Signature	September/October 2024

5 Quality Assurance Requirements

The organisation conducting these activities should have an ITER approved QA Program or an ISO 9001 accredited quality system.

6 Contract Duration and Execution

The ITER Organization shall award the Service Contract around October 2024. The contract duration shall be 19 months.

7 Experience

The candidates shall need to demonstrate that they have the capabilities to supply the required goods and services in full compliance with the applicable standards as well as with the ITER quality and safety requirements.

8 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.

All consortium members shall be registered in IPROC.

9 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.

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

To: Domestic Agencies (DAs)

IO Tender Reference: IO/24/OT/ 10028547 /YLI

Title: Design, Assembly, and Operation of Large-Scale Hydrogen-Qualified Laboratory for Testing ITER Prototype Catalytic Hydrogen Reactors

Subject: Prior Indicative Notice (PIN)

Dear colleagues,

The ITER Organization intends to launch an Open Tender process in the coming weeks as indicated above and in accordance with the details in the attached Prior Indicative Notice (PIN). In this regard, and to provide some introductory information about the forth-coming tender, we kindly request the attached PIN and Technical Summary (AKHHRV_v1_0) to be published on your DA website with immediate effect until 14/06/2024.

china
eu
india
japan
korea
russia
usa

The advance notification is to alert companies, institutions or other eligible entities to the forth-coming tender, and provide information to promote healthy competition, allowing interested parties time to decide whether to participate in the tender or not.

Please could you kindly acknowledge receipt of this e-mail and confirm once the PIN is published on your website.

Yours sincerely

Ye Li

Assistant Buyer
Construction, Assembly & Logistics Section
Procurement Division

Contact: Ye LI, Procurement & Contracts Division - Tel. +33 4 42 17 81 73 - e-mail: Ye.Li@iter.org

ANNEX I

EXPRESSION OF INTEREST & PIN ACKNOWLEDGEMENT

To be returned by e-mail to: Ye.Li@iter.org with copy to Andrew.Brown@iter.org

TENDER No.	**IO/24/OT/ 10028547 /YLI**
DESIGNATION of SERVICES:	**Design, Assembly, and Operation of Large-Scale Hydrogen-Qualified Laboratory for Testing ITER Prototype Catalytic Hydrogen Reactors**
OFFICER IN CHARGE:	**Ye LI – 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

☐ NO, but we shall register before the tender launch

……

Signature: COMPANY STAMP

Name: .....

Position: .....

Tel: .....

E-mail .....

Date: .....

IDM UID
AKHHRV
VERSION CREATED ON / VERSION / STATUS
18 Mar 2024 / 1.0 / Approved
EXTERNAL REFERENCE / VERSION

Technical Specifications (In-Cash Procurement)

Technical Summary for CHOP Qualification and Testing facility

This technical summary is prepared for the launch of the procurement process for the CHOP qualification and testing facility. This summary will be followed by a detailed technical specification ITER_D_8PJ9VJ.

1. Background

The Vacuum Vessel Pressure Suppression System (VVPSS) is a system designed to protect the ITER Vacuum Vessel (VV) during accidental events. The VVPSS has three main functions; protect VV from overpressure, maintain dynamic confinement in the event of breach of VV, and reduce the concentrations of hydrogen, tritium, and dust sent to the downstream Detritiation System (DS).

The Hydrogen Mitigation System (HMS) is a subsystem of the VVPSS, specifically designed to perform the removal of hydrogen, tritium and dust from the non-condensable process gas stream. HMS accomplishes the reduction in concentration of hydrogen and dust through a series of igniting, scrubbing, and catalysed oxidation processes.

IO has developed two prototype catalytic hydrogen oxidation reactors, hereafter referred to the Catalytic Hydrogen Oxidation Prototypes (CHOP), which will be tested in an experimental facility to determine their functional performances and identify the preferred arrangement.

IO is seeking a partner to develop and operate the CHOP testing facility. This document is a summary of the technical specification for the CHOP Facility and corresponding test program.

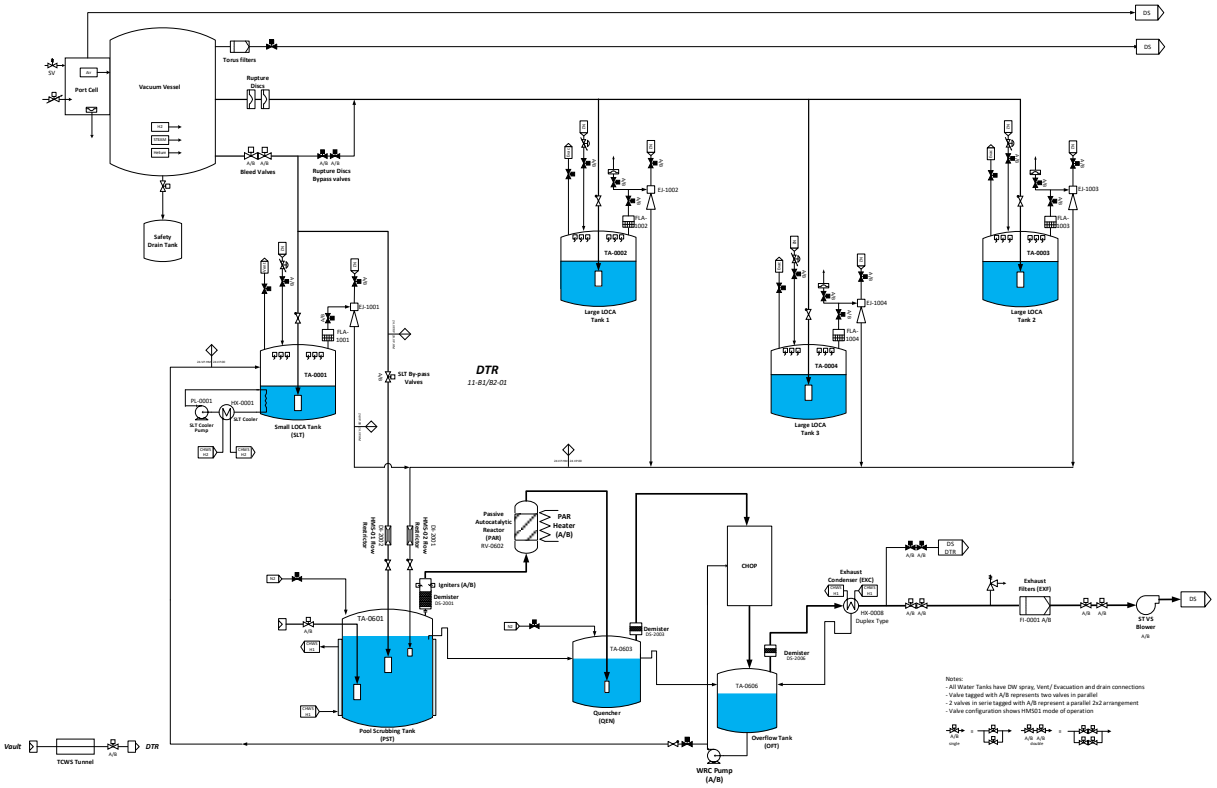

Figure 1 Process flow diagram of VVPSS indicating the location of CHOP

2. Scope of Work

Above all other requirements of this specification, the Contractor shall construct and operate a test facility that enables the determination of the performance of two free-issued prototype reactors.

The specific scope of work for this Contract shall include, but is not limited to, the following tasks:

1. Production of documentation as required by this specification;
2. Procurement of necessary equipment (that is not provided by the IO);
3. Assembly and preparation of the testing facility;
4. Commissioning and qualification of the testing facility;
5. Testing activities and supporting services (including modification of the test facility configuration);
6. Disassembly and return of all equipment to IO.

3. Scope of Supply

The Scope of supply under this Specification shall include as a minimum:

a) Quality Plan
b) Facility assembly documentation, including, but not limited to:
    a. Facility general arrangement drawing(s)
    b. Facility risk assessment, including a hydrogen safety plan (accident prevention and mitigation plan)
    c. Equipment list/datasheets
    d. Safety equipment test certificates
    e. Instrument calibration certificates
    f. Facility Acceptance Test (FAT) report for completed facility
c) Facility: A test facility capable of performing all the tests listed in Section 1111, the list of equipment is not limited to:
    a. Pipework
    b. Valves
    c. Instrumentation
    d. Flame Arrestors
    e. Support structures
    f. Data-logging, visualization and control equipment
    g. Consumables (gas cylinders)
    h. Access platform / Scaffolding
d) Solid state storage device containing all testing data

4. Deliverables

The Contractor shall develop, and submit to IO, a schedule demonstrating the ability to meet the expected deliverable due dates.
The estimated duration of this contract is 18 months from the Kick-off meeting.

Table 1: List of deliverables

Number	Deliverable	Due Date
D1	Kick-off meeting minutes	T0
D2	Quality Plan	T0 + 0.5 month
D3	Facility Design Report and Bill of Materials (HP)	T0 + 3 months
D4	Facility Acceptance Tests (HP)	T0 + 10 months
D5	Facility As-Built Drawings	T0 + 11 months
D6	Testing Phase 1 data	T0 + 12 months
D7	Facility Modifications (HP)	T0 + 12.5 months
D8	Testing Phase 2 data	T0 + 13.5 months
D9	Facility Modifications (HP)	T0 + 14 months
D10	Testing Phase 3 data	T0 + 15 months
D11	Delivery of equipment to IO (free issue and procured equipment)	T0 + 18 months

A testing period of 4 to 8 weeks is anticipated. The Contractor shall anticipate an extension of testing operations by 1 month.

5. Safety Requirements

The workshop shall employ an Occupational Health and Safety system and have ISO 18001 certification. The workshop shall have an Environmental Management System and have ISO 14001 certification. The workshop shall implement applicable ATEX guidelines as described in directive 2014/34/EU.
The CHOP Facility will contain fluids at elevated temperature, fluids under pressure, flammable gases, electrical currents, the lifting of heavy equipment and working at height. The hazards introduced by the CHOP facility shall be identified and a dedicated risk assessment and mitigation process implemented. The ITER Organization can assist the Contractor in the risk assessment process if required.
All personnel performing activities with the potential to cause harm shall be suitably trained and qualified for the tasks they are undertaking.

6. Control and Surveillance

ITER is a Nuclear Facility identified in France by the number-INB-174 (“Installation Nucléaire de Base”). The testing activities undertaken using the CHOP Facility are Protection Important Activities, i.e., they are activities that impact the safety of the ITER Facility. Under the French Order of 7th February 2012 (the “INB Order”) [12] which establishes the general rules for licensed nuclear installations, Contractors and Sub-contractors must be informed that:

- The INB Order applies to all protection important components and the protection important activities.
- Compliance with the INB Order must be demonstrated in the chain of external Contractors.
- In application of article II.2.5.4 of the INB Order, the Nuclear Operator (IO) shall undertake supervision of activities undertaken by external interveners (The Contractor and subcontractors).

7. Facility description

7.1. Proposal 1

IO has developed a schematic for the CHOP testing and qualification facility and is shown in Figure 2.

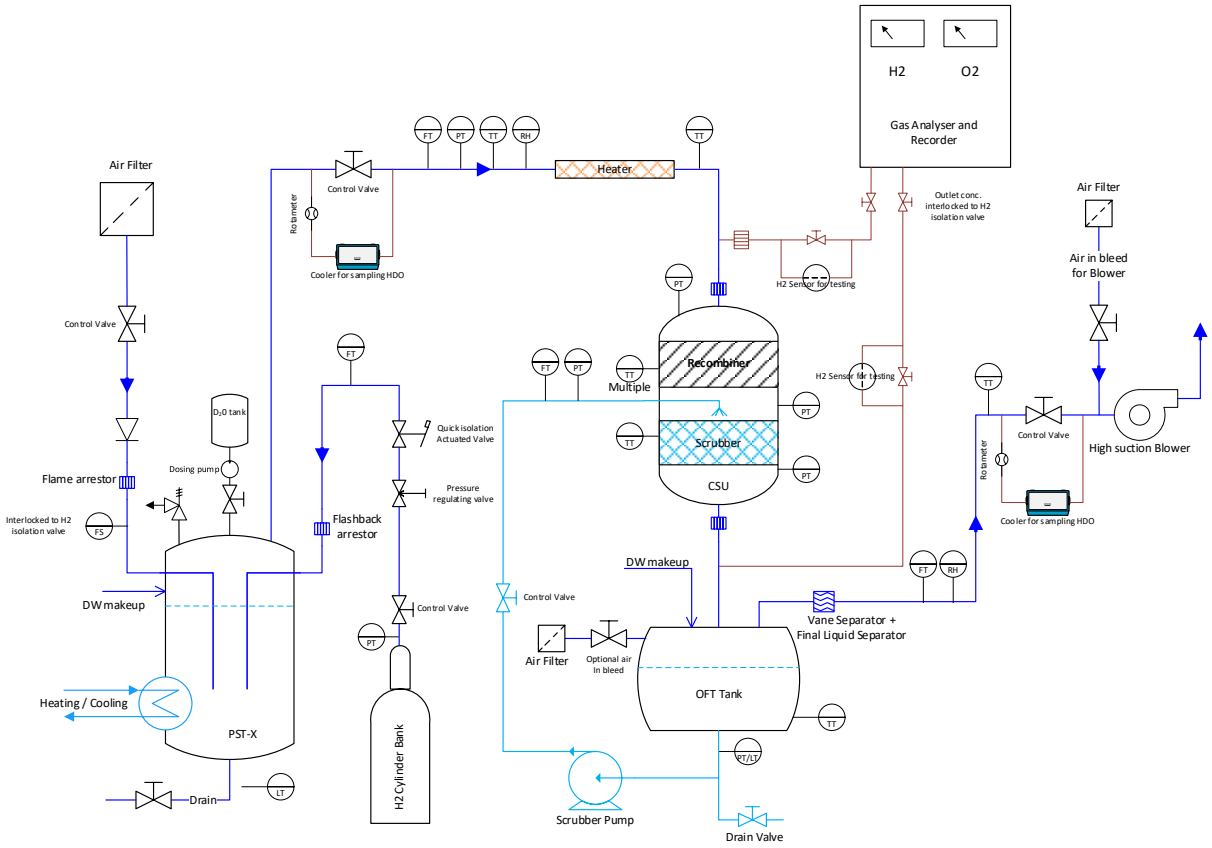

Figure 2: CHOP testing and qualification facility schematic (IO proposal)

The scheme proposed in Figure 2 includes the following components:

i. Three Air Filter for Inlet, OFT in-bleed and Blower in-bleed
ii. PST-X vessel (free issue by IO)
iii. D_20 dossing system
iv. H_2 cylinder bank
v. HDO sample collection system at inlet and outlet
vi. Inline heater
vii. Gas analyser (O_2 & H_2 analysis at inlet and H_2 analysis at outlet)
viii. CHOP vessels (free issue of two vessels by IO)
ix. OFT vessel (free issue by IO)
x. Scrubber pump
xi. Vane separator + Final liquid separator
xii. High suction blower
xiii. Valves
xiv. Flame arrestors for H_2 safety
xv. Instruments

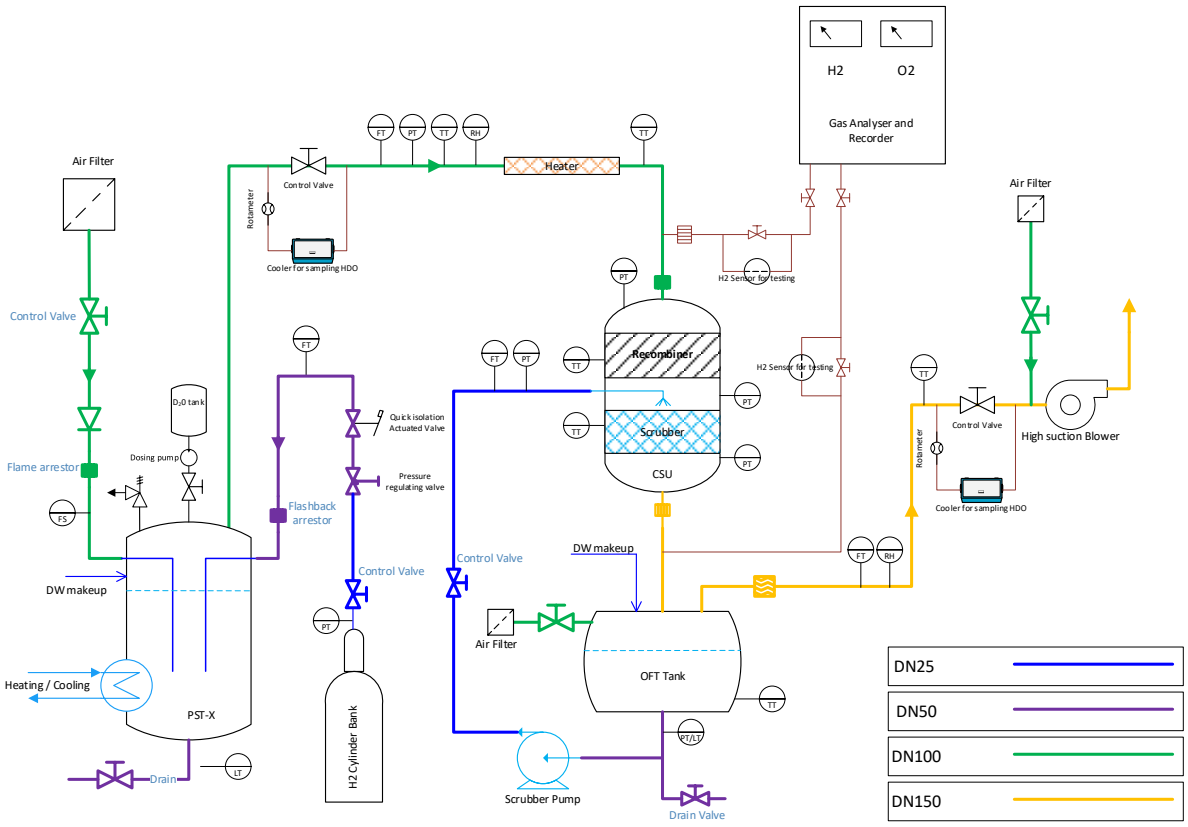

Figure 3: Pipeline size (estimate)

IO intends to test two prototypes one with a series configuration of the catalyst and scrubbing section and the second with an annular configuration of the catalyst and scrubbing sections (Figure 4 & Figure 5).

The annular vessel can be configured in two ways, one with the catalyst on the inside and the scrubbing section forming an annular arrangement around the catalyst section (Figure 5). The second one with a cylindrical scrubbing section with the catalyst forming an annular arrangement around the scrubbing section (Figure 4). Both arrangements must be tested at the qualification facility to ascertain the configuration which delivers the best performance.

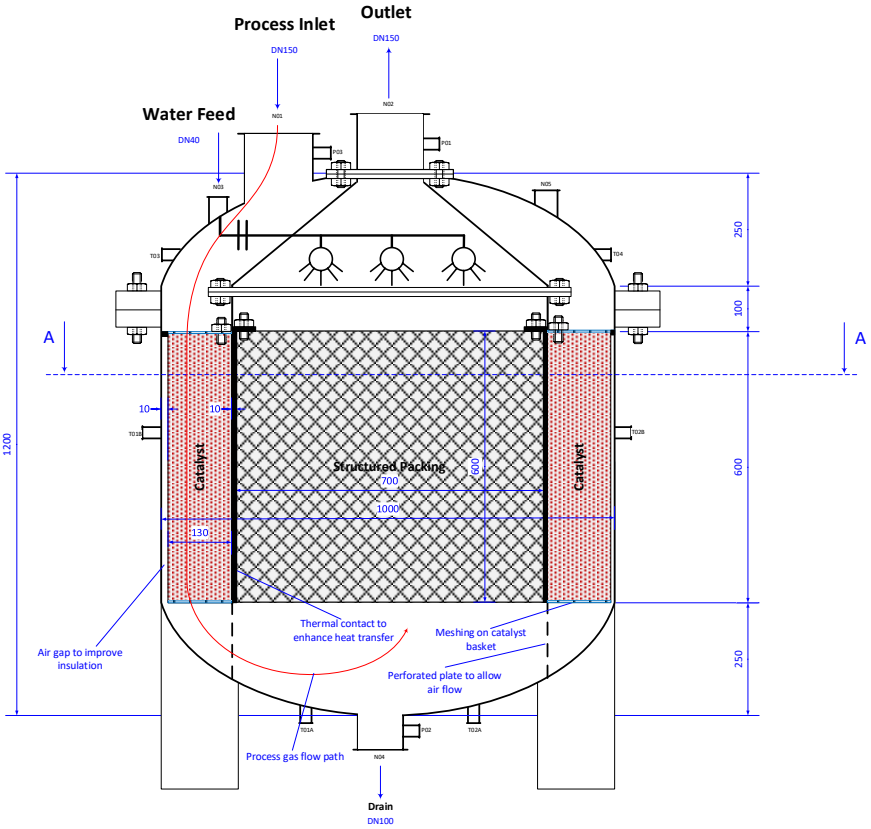

Figure 4: Annular configuration with cylindrical scrubbing stage

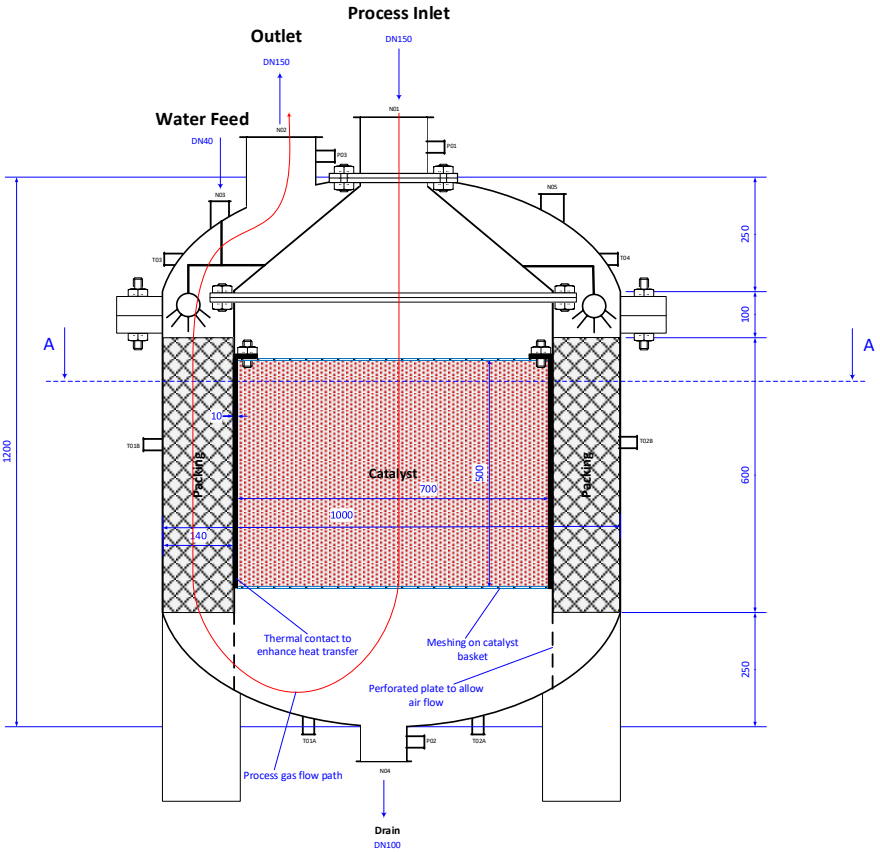

Figure 5: Annular configuration with annular scrubbing section

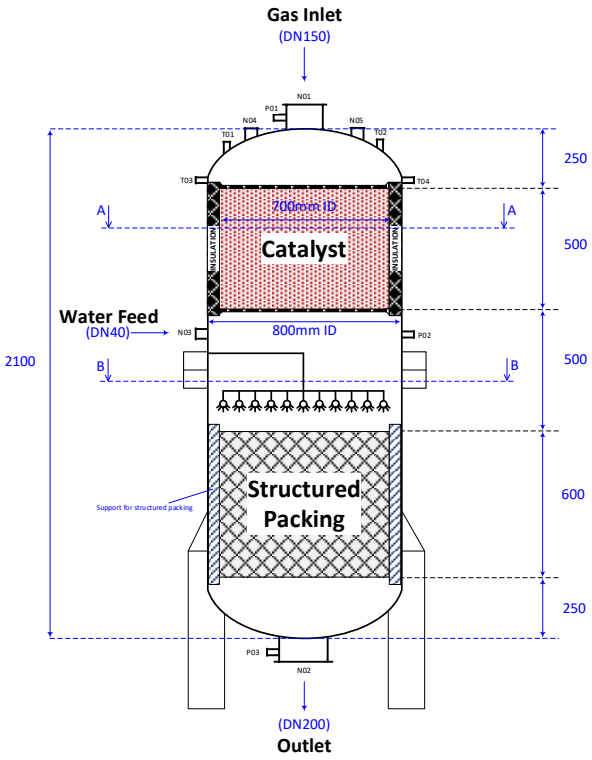

Figure 6: Series configuration of CHOP

7.2. Proposal 2

In this second scheme, the requirements for the input and output streams to the prototype are defined. This input stream may then be produced using services already available at the testing workshop. In this way the required amount of facility assembly is reduced, and advantage is taken of existing services.

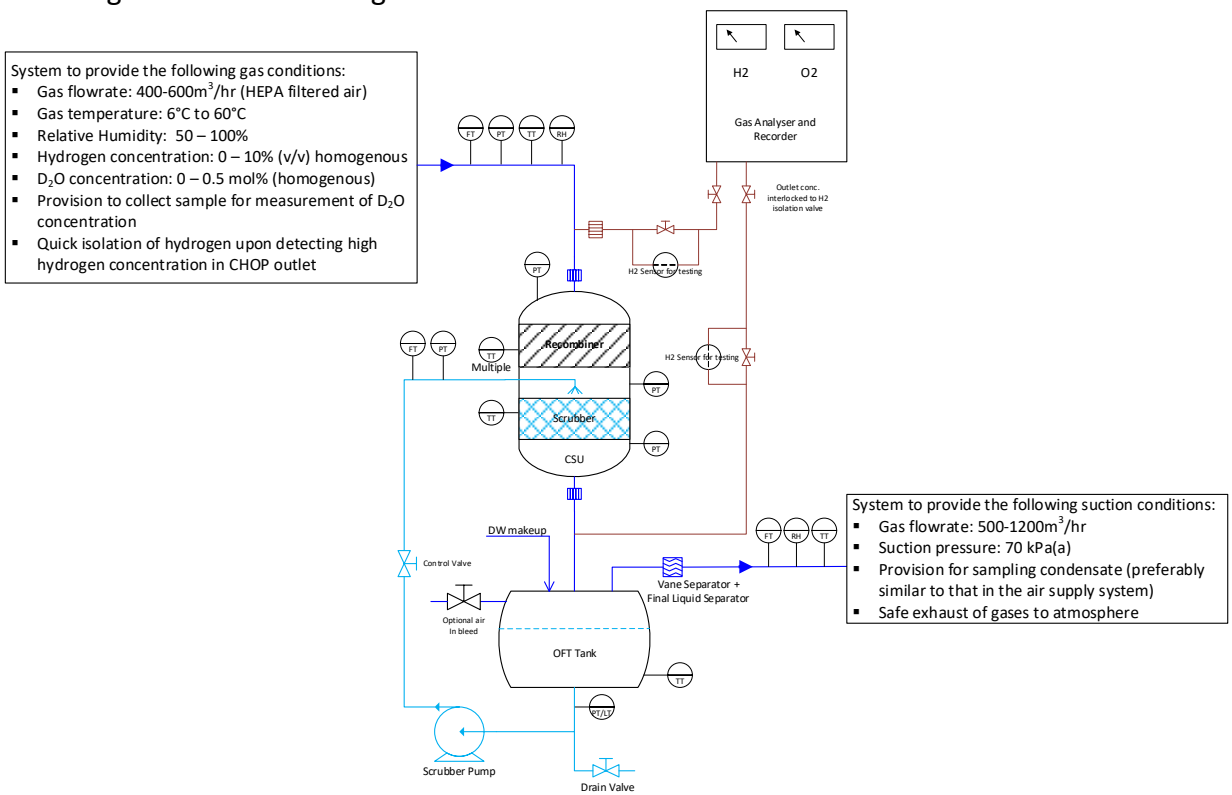

Figure 7: Second proposal defining the requirements from the facility

The scheme proposed in Figure 7 includes the following components:

i. Air Filter for OFT in-bleed

ii. Gas analyser (O_2 & H_2 analysis at inlet and H_2 analysis at outlet)
iii. CHOP vessels (free issue by IO)
iv. OFT vessel (free issue by IO)
v. Scrubber pump
vi. Vane separator + Final liquid separator
vii. Valves
viii. Flame arrestors for H_2 safety
ix. Instruments

8. Equipment specification

Table 2 lists the major specifications of the components of the facility described in Figure 2.

Table 2: Equipment specification table

Parameter	Value	Remarks
Facility design pressure	10 bar(g)	Considering H_2 deflagration
Facility design temperature	230 °C (between heater and CHOP)	
	60 °C (all other pipeline)	
Material of Construction	Stainless Steel	Preferably SS304L
Dilution air supply flowrate	500m^3/hr	HEPA filtered
OFT air supply flowrate	400-1200 m^3/hr	HEPA filtered
Blower air in-bleed flowrate	400-1200 m^3/hr	HEPA filtered
Air supply temperature	Ambient (20-30°C)	
Air supply pressure	Atmospheric (1 Bar(a))	
Hydrogen supply flow control	5-40 Nm^3/hr (±1% accuracy)	Quick isolation valve on hydrogen supply to isolate
Air Heater outlet temperature range	40-100 °C	15kW power (inlet at 20°C with 500Nm^3/hr)
Scrubber pump flowrate	1-8 m^3/hr	Pump type: canned motor Fluid – DM water
Scrubber pump developed head	2 bar(g)	
Vane separator efficiency	>95% removal of droplets above 20µm	
Mesh separator efficiency	>95% removal of droplets above 5µm	
Blower flow rate	800-2000Nm^3/hr	
Blower suction pressure	70 kPa(a)	(likely multi-stage blower with discharge to atmosphere)
Hydrogen analyser measurement range	0-10% (v/v) (accuracy ±0.1% or better)	
Oxygen analyser measurement range	0-30% (v/v) (accuracy ±0.1% or better)	

D_2O dosing rate	0.02-4ml/min (accuracy ±1% or better)	Dosing system should have volume integration function
Workshop size	60-80 m^2 (approx.)	
Crane capacity	2 MTe (min)	Mobile/ fixed overhead

Table 3: Valve list (indicative)

Tag	Element	Purpose
	Pressure Regulator	Hydrogen Supply
	Actuated Isolation Valve	Hydrogen Shutoff (Fail Close)
	Manual Control Valve	Hydrogen Supply
	Manual Valve	D_2O Supply
	Relief Valve	Overpressure protection of PST-X
	Manual Control Valve	Air supply control valve
	Non-Return Valve	Air supply to PST-X
	Manual Valve	PST-X Drain
	Manual Valve	OFT Drain
	Manual Control Valve	OFT Air in bleed
	Manual Control Valve	Scrubber flow control
	Manual Control Valve	Blower Air in Bleed
	Manual Control Valve	For introducing flow through inlet HDO Sampling
	Manual Control Valve	For introducing flow through outlet HDO Sampling

Table 4: Utility requirement

Utility	Requirement	Comments
Demineralized Water	$40m^3$	
Chilled Water	Min 40 kW cooling capacity	Supply at 6 °C, return at 14 °C max
Steam or Hot water	Min 40 kW heating (optional)	
Hydrogen gas supply	Bottles of hydrogen gas with appropriate pressure regulating valve. $250Nm^3$	An appropriate space for storage of high-pressure, flammable gas bottles shall be provided.
D_2O supply	D_20 at 99% (approx.) purity 10 litres	
Power supply	50 kW, both 3-phase & 2 phase supplies	(power for blower, air heater, pump, and data acquisition/control equipment)

9. Facility Layout

IO has developed approximate layout diagrams of the facility to better understand the space requirement for the CHOP testing and qualification facility. It shall be noted that the scheme proposed in Figure 8 and Figure 9 are indicative and not accurate.

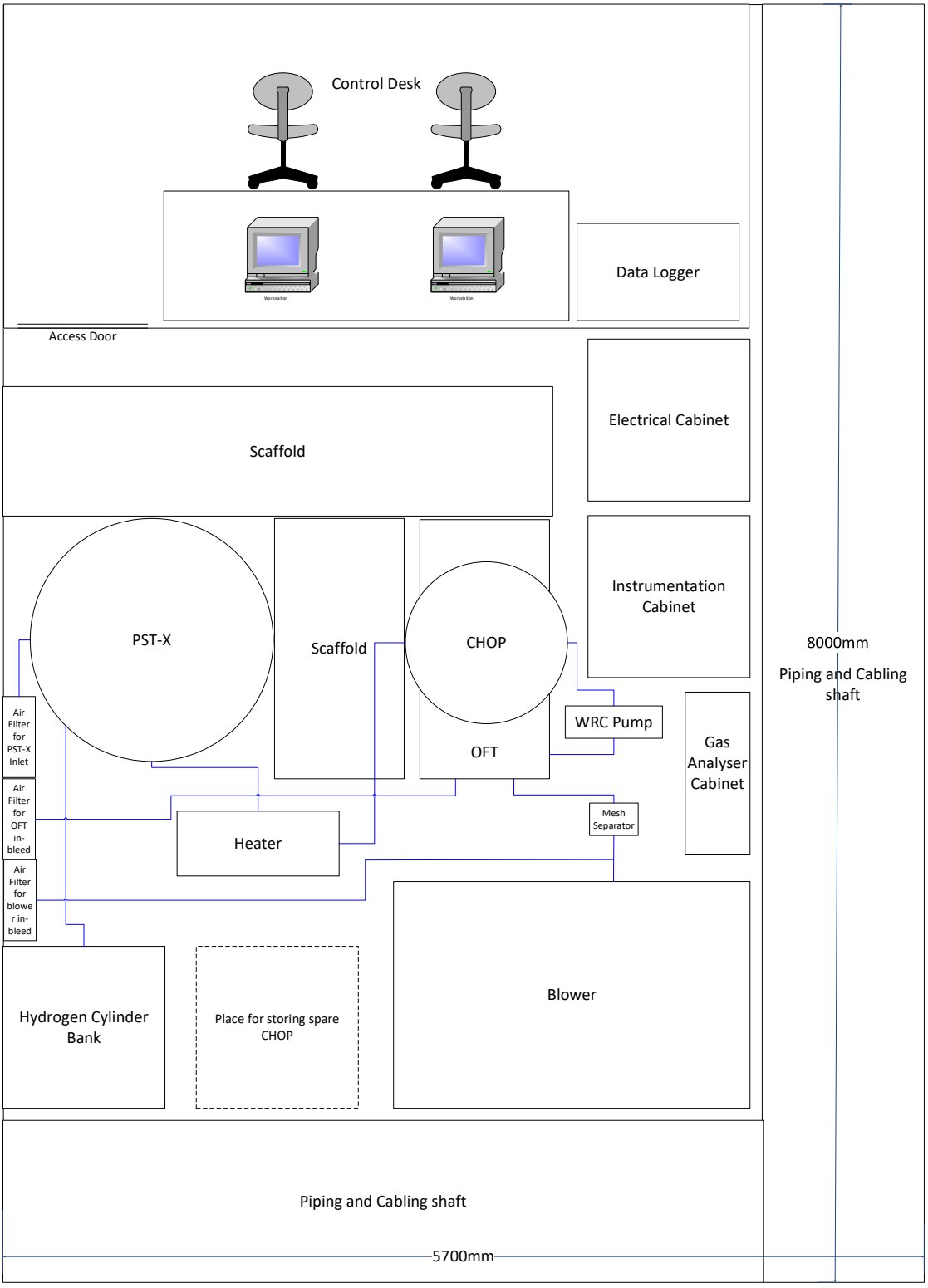

Figure 8: Plan of proposed CHOP qualification facility

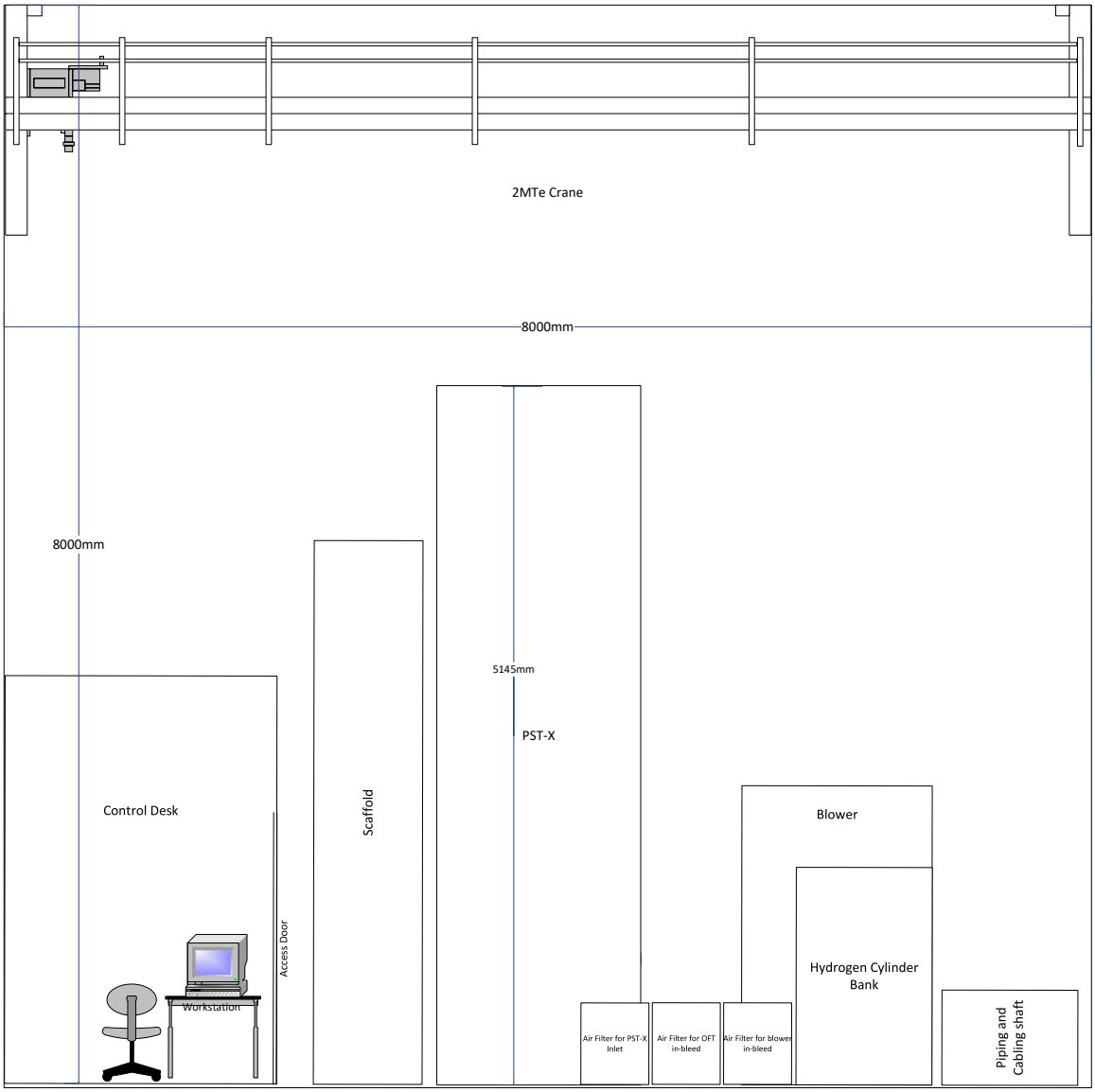

Figure 9: Elevation of proposed CHOP qualification facility

10. Facility Modification

The Contractor shall modify the facility to install the alternative Prototypes, additional equipment, and to perform additional measurements. As a minimum, the Contractor shall consider the following activities:

- Installation of Prototype 1;
- Reconfiguration of Prototype 1
- Installation of Prototype 2;
- Replacement of the catalyst two times for each prototype.

11. Proposed Test Matrix

The testing activity will be performed in stages, the following lists the proposed testing activities, the timing mentioned is approximate:

- Testing of Annular vessel with cylindrical structured packing with hydrogen (20hrs)

- Testing of Annular vessel with annular structured packing with hydrogen (10hrs)
- Testing of Series vessel with hydrogen (10hrs)
- Testing of Annular vessel with cylindrical structured packing with HDO (10hrs)
- Testing of Annular vessel with annular structured packing with HDO (20hrs)
- Testing of Series vessel with HDO (10hrs)