

外部委託業者の募集

References: IO/26/OT/10035629/JGO

“Supply Contract for Canned Motor Pumps of Chemical and Volume Control System (CVBD) and Vacuum Vessel Primary Heat Transfer System (VVPHTS) “

(化学・体積制御系 (CVBD) および真空容器一次熱伝達系 (VVPHTS) 向けキャンドモータポンプ供給契約)
IO 締め切り 20226 年 10 月 9 日(金)

○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。

○背景

ITER は平和利用の核融合発電の科学的小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・デュランズ 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。

○作業範囲

本調達手続きは、化学・体積制御系 (CVBD) および真空容器一次熱伝達系 (VV PHTS) 向けキャンドモータポンプの供給契約を締結することを目的としています。

本契約の作業範囲には、以下のITER設備に供給するキャンドモータポンプについて、設計、品質確認、製造、検査、試験、性能確認、塗装、梱包、積込みならびにITERへの安全な納入に関する一切の業務が含まれます。

- IBED一次熱伝達系 (PHTS) 向け化学・体積制御系 (CVBD)
- 真空容器一次熱伝達系 (VV PHTS)

本契約では、これらの設備に設置される合計6台のキャンドモータポンプを対象としています。技術概要書「FXHR9C_v1_0」には、本契約の全体的な作業範囲および技術要求事項の概要が示されています。詳細な要求事項、設計条件、技術データ、品質確認要件、試験要件ならびにその他の契約上の義務については、以下の技術仕様書に定める内容が適用されます。

- CVBD充てんポンプ技術仕様書 (ITER_D_G2R52F) (付属書IIに添付)
- VV PHTSキャンドモータポンプ技術仕様書 (ITER_D_G42GE6) (オープンテンダー文書の一部と

して発行される予定です。)

詳細については、添付付属書Ⅱの技術仕様書G2R52F_v1_3をご参照ください。

○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。

○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	2026 年 9 月 22 日
関心表明フォームの提出	2026 年 10 月 9 日
入札開始	2026 年 10 月 16 日
明確化のための質問（もしあれば）と回答	入札提出の 5 日前
入札提出	2026 年 11 月 27 日
入札評価と契約授与	2027 年 Q1
契約調印	2027 年 Q1

○契約期間と実行

ITER機構は2027年のQ1に供給契約を授与する予定です。予想される契約期間は44か月の予定です。

○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。本プロジェクトは高度な技術的複雑性を有しているため、ポンプメーカーがコンソーシアムの代表企業として参加し、ポンプの設計、製造および試験に関する社内能力を保有していることが求められます。

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 Canned Motor Pumps of Chemical and Volume Control System (CVBD) and Vacuum Vessel Primary Heat Transfer System (VV PHTS)**」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

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PRIOR INFORMATION NOTICE (PIN)

OPEN TENDER SUMMARY

IO/26/OT/10035629/JGO

for

Supply Contract for Canned Motor Pumps of Chemical and Volume Control System (CVBD) and Vacuum Vessel Primary Heat Transfer System (VV PHTS)

Prior Indicative Notice annexes:

- Annex I: Expression of Interest Form
- Annex II: Technical Summary FXHR9C_v1_0 and Technical Specification G2R52F_v1_3

IO Contact Persons: Jingyu.Gao@iter.org and Andrew.Brown@iter.org

Abstract

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

1 Introduction

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

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

2 Background

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

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

3 Scope of Work

The present tender process is aiming to set up a Supply Contract for Canned Motor Pumps of Chemical and Volume Control System (CVBD) and Vacuum Vessel Primary Heat Transfer System (VV PHTS).

The scope of work includes complete design, qualification, manufacturing, inspection, testing, performance, painting, packing, loading, safe delivery to ITER of the canned motor pumps supplied for the following ITER systems:

- Chemical and Volume Control System for IBED PHTS (CVBD);
- Vacuum Vessel Primary Heat Transfer System (VV PHTS).

The contract covers a total of six (6) canned motor pumps installed in these systems. The Technical Summary FXHR9C_v1_0 provides a high-level overview of the overall scope and technical requirements. Detailed requirements, design conditions, technical data, qualification requirements, testing requirements, and other contractual obligations shall be taken from the respective technical specifications listed below:

- Technical Specification for CVBD Charging Pumps (ITER_D_G2R52F), annexed in Annex II;
- Technical Specification for VV PHTS Canned Motor Pumps (ITER_D_G42GE6), to be issued as part of the open tender package.

For more details, please refer to Annex II: Technical Summary FXHR9C_v1_0 and Technical Specification G2R52F_v1_3.

4 Procurement Process & Objective

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

The Procurement Procedure selected for this tender is called the Open Tender procedure.

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

- Step 1- Prior Information Notice (PIN)
The Prior Information Notice is the first stage of the Open Tender process. The IO formally invites interested Suppliers to indicate their interest in the competitive process by returning to the Procurement officer in charge the attached “Expression of Interest and PIN Acknowledgement” (Annex I) by the date indicated under the procurement timetable.

Special attention:

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

When registering in Ariba (IPROC), suppliers are kindly requested to nominate at least one contact person. This contact person will be receiving the notification of publication of the Request for Proposal and will then be able to forward the tender documents to colleagues if deemed necessary.

➤ **Step 2 - Invitation to Tender**

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

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

➤ **Step 3 – Tender Evaluation Process**

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

➤ **Step 4 – Contract Award**

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

Procurement Timetable

The tentative timetable is as follows:

Milestone	Date
Publication of the Prior Indicative Notice (PIN)	22 September 2026
Submission of Expression of Interest form	No later than 9 October 2026
Tender launch	No later than 16 October 2026
Clarification Questions (if any) and Answers	5 days before submission deadline
Tender Submission	27 November 2026
Tender Evaluation & Contract Award	Q1 2027
Contract Signature	Q1 2027

5 Quality Assurance Requirements

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

6 Contract Duration and Execution

The ITER Organization is planning to award the Supply Contract in Q1 2027. The estimated contract duration is 44 months.

7 Candidature

Participation is open to all legal entities participating either individually or in a grouping/consortium. A legal entity is an individual, company, or organization that has legal rights and obligations and is established within an ITER Member State, being, the European Union (represented by EURATOM), Japan, the People's Republic of China, India, the Republic of Korea, the Russian Federation and the USA.

Legal entities cannot participate individually or as a consortium partner in more than one application or tender of the same contract. A consortium may be a permanent, legally established grouping, or a grouping which has been constituted informally for a specific tender procedure. All members of a consortium (i.e. the leader and all other members) are jointly and severally liable to the ITER Organization.

In order for a consortium to be acceptable, the individual legal entities included therein shall have nominated a leader with authority to bind each member of the consortium, and this leader shall be authorised to incur liabilities and receive instructions for and on behalf of each member of the consortium. **Considering the project complexity, it is required that the pump manufacturer shall be the consortium leader, having in-house capabilities for pump design, manufacturing, and testing.**

It is expected that the designated consortium leader will explain the composition of the consortium members in its offer. Following this, the Candidate's composition must not be modified without notifying the ITER Organization of any changes. Evidence of any such authorisation shall be submitted to the IO in due course in the form of a power of attorney signed by legally authorised signatories of all the consortium members.

Any consortium member shall be registered in IPROC.

8 Sub-contracting Rules

All sub-contractors who will be taken on by the Contractor shall be declared with the tender submission in IPROC. Each sub-contractor will be required to complete and sign forms including technical and administrative information which shall be submitted to the IO by the tenderer as part of its tender.

All declared sub-contractors must be established within an ITER Member State in order to participate.

The IO reserves the right to approve (or disapprove) any sub-contractor which was not notified in the tender and request a copy of the sub-contracting agreement between the tenderer and its subcontractor(s). Rules on sub-contracting are indicated in the RFP itself.

Technical Specifications (In-Cash Procurement)

Technical Summary for CVBD and VV PHTS Canned Motor Pumps

This is a technical summary to describe an overview of scope and requirement for the following two technical specifications

- Technical Specification for CVBD Charging Pumps (26CVBD-PL-5701 and 26CVBD-PL-5703)(G2R52F)
- Technical Specification for VV PHTS Canned Motor Pumps (26PHVV-PL-1801, 26PHVV-PL-1901, 26PHVV-PL-5000, 26PHVV-PL-5002)(G42GE6)

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1 Purpose

This Technical Summary provides a high-level overview of the scope and technical requirements for the canned motor pumps supplied for the following ITER systems:

- Chemical and Volume Control System for IBED PHTS (CVBD)
- Vacuum Vessel Primary Heat Transfer System (VV PHTS)

The contract covers a total of six (6) canned motor pumps installed in these systems. The purpose of this document is to provide a consolidated summary of the main scope of supply, equipment characteristics, and key technical requirements applicable to these pumps. **This document is intended for general understanding only and does not replace the applicable technical specifications.**

Detailed requirements, design conditions, technical data, qualification requirements, testing requirements, and other contractual obligations shall be taken from the respective technical specifications listed below:

- Technical Specification for CVBD Charging Pumps (ITER_D_G2R52F)
- Technical Specification for VV PHTS Canned Motor Pumps (ITER_D_G42GE6)

In case of discrepancy, the requirements of the applicable technical specification shall govern.

2 Overview of Scope and Requirements

The scope and principal technical requirements of the CVBD and VV PHTS canned motor pumps are summarized in Annex A. The Annex A provides a consolidated comparison of the six (6) pumps, including:

- Basic information
- Process requirements
- Layout & Weight
- Motor Data
- Basic scope of supply
- Environmental conditions

The pumps installed in the CVBD and VV PHTS systems are based on a common technical concept and therefore share a large portion of their scope and requirements. Any significant differences between the two applications or among the six (6) pumps are identified in Annex A.

In addition, the pumps shall be qualified to demonstrate their capability to withstand the applicable environmental conditions and process loading conditions. **Such qualification may be performed in accordance with RCC-M, ASME QME-1, or an equivalent recognized qualification standard, as defined in the applicable technical specification.**

For detailed requirements, reference shall be made to the applicable technical specification for each pump.

Appendix A - Summary of CVBD and VV PHTS Canned Motor Pumps

Major differences are highlighted in **bold** in the following table.

	Item No.		26CVBD-PL-5701	26CVBD-PL-5703	26PHVV-PL-1801	26PHVV-PL-1901	26PHVV-PL-5000	26PHVV-PL-5002
	Equipment name	Unit	CVBD Charging Pump 1	CVBD Charging Pump 2	VV PHTS Filter Booster Pump	VV PHTS Decay Heat Pump	VV PHTS Volume Control Pump 1	VV PHTS Volume Control Pump 2
A	Basic Informatin							
A1	Technical Specification	-	Technical Specification for CVBD Charging Pumps (ITER_D_G2R52F)	Technical Specification for CVBD Charging Pumps (ITER_D_G2R52F)	Technical Specification for VV PHTS Canned Motor Pumps (ITER_D_G42GE6)	Technical Specification for VV PHTS Canned Motor Pumps (ITER_D_G42GE6)	Technical Specification for VV PHTS Canned Motor Pumps (ITER_D_G42GE6)	Technical Specification for VV PHTS Canned Motor Pumps (ITER_D_G42GE6)
A2	Pump Type	-	Canned Motor Pump - Horizontal, API 685	Canned Motor Pump - Horizontal, API 685	Canned Motor Pump - Horizontal, API 685	Canned Motor Pump - Horizontal, API 685	Canned Motor Pump - Horizontal, API 685	Canned Motor Pump - Horizontal, API 685
A3	Pump cooling method	-	Non-cooling water type	Non-cooling water type	Non-cooling water type	Non-cooling water type	Non-cooling water type	Non-cooling water type
A4	Location in Tokamak Complex	-	B14-L4-21 (Vault Annex (PHTS drainage and Drying System))	B14-L4-21 (Vault Annex (PHTS drainage and Drying System))	B11-L3-03E (Upper Pipe Chase E)	B11-B1-01 (TCWS Drain Tanks Upper Level)	B11-L4-04 (TCWS/CVCS/TBM Area)	B11-L4-04 (TCWS/CVCS/TBM Area)
A5	Safety Important Class	-	SIC-1 (for confinement only)	SIC-1 (for confinement only)	SIC-2 (for confinement only)	SIC-2 (for confinement and functionality)	SIC-2 (for confinement only)	SIC-2 (for confinement and functionality)
A6	Quality Class	-	QC-1	QC-1	QC-1	QC-1	QC-1	QC-1
A7	Seismic Class	-	SC1(S)	SC1(S)	SC1(S)	SC1(SF)	SC1(S)	SC1(SF)
A8	Qualification requirement	-	RCC-M / ASME QME-1 / Equivalent	RCC-M / ASME QME-1 / Equivalent	RCC-M / ASME QME-1 / Equivalent	RCC-M / ASME QME-1 / Equivalent	RCC-M / ASME QME-1 / Equivalent	RCC-M / ASME QME-1 / Equivalent
B	Process Requirement							
B1	Liquid type	-	Demineralized water with hydrazine	Demineralized water with hydrazine	Demineralized water with hydrazine	Demineralized water with hydrazine	Demineralized water with hydrazine	Demineralized water with hydrazine
B2	Radioactivity in Pumped Fluid	-	Yes	Yes	Yes	Yes	Yes	Yes
B3	Flow (Rated)	m3/h	164	18	37.2	372 (Preliminary)	40	23.4
B4	Head (Rated)	m	187	356	59.4	14 (Preliminary)	49	125
B5	Liquid Temp (Rated)	degC	50	50	103	195 (Preliminary)	90	132
B6	Suction Pressure (Rated)	BarG	4.1	4.0	2.3	18 (Preliminary)	1	4.7
B7	Discharge Pressure (Rated)	BarG	22.3	38.6	8.0	25 (Preliminary)	5.72	16.72
B8	NPSHa	m	51.4	50.6	18.4	45.2 (Preliminary)	18	40
B9	Hydraulic Power	kW	82.5	17.4	5.4	7.4 (Preliminary)	4.5	6.5
B17	Design Pressure (MAWP)	BarG	59	59	25	25	28	28
B18	Design Temp	degC	100	100	220	220	190	190
C	Layout & weight							
C1	LxWxH (Max)	mm	2650 x 1360 x 1170 (LxW : baseplate size)	2560 x 1300 x 1170 (LxW : baseplate size)	Later (Refer to Technical Spec (ITER_D_G42GE6))	Later (Refer to Technical Spec (ITER_D_G42GE6))	Later (Refer to Technical Spec (ITER_D_G42GE6))	Later (Refer to Technical Spec (ITER_D_G42GE6))
C2	Weight (Max)	kg	7500	7500	1000	3400	7500	7500
C3	Nozzle Orientation	-	End-Top	Top-Top	End-Top	End-Top	End-Top	End-Top
C5	Inlet Piping Spec	-	4-S3S0150	4-S3S0150	4-S3S0300	4-S3S0300	4-S3S0300	4-S3S0300
C6	Inlet Nozzle size/Rating/Face	inch/-/	6(=150DN) / 300# / RF	3(=80DN) / 300# / RF	2.5(=DN 65) / 300# / RF	8(=DN 200) / 300# / RF	3(=DN 80) / 300# / RF	3(=DN 80) / 300# / RF
C7	Disc Piping Spec	-	4-S3S0600	4-S3S0600	4-S3S0300	4-S3S0300	4-S3S0300	4-S3S0300
C8	Disc Nozzle Size/Rating/Face	inch/-/	6(=150DN) / 600# / RF	3(=80DN) / 600# / RF	2.5(=DN 65) / 300# / RF	8(=DN 200) / 300# / RF	2.5(=DN 65) / 300# / RF	2.5(=DN 65) / 300# / RF
C11	Cooling Water Piping	-	Not Planned	Not Planned	Not Planned	Not Planned	Not available	Not available
C12	Layout of Auto Recirculation Valve	-	Mounted directly on the pump discharge flange	Mounted directly on the pump discharge flange	Mounted directly on the pump discharge flange	N/A	Mounted directly on the pump discharge flange	Mounted directly on the pump discharge flange
E	Motor Data							
E1	Motor Rated	kW	By Contractor	By Contractor	By Contractor	By Contractor	By Contractor	By Contractor
E2	Motor Voltage/ Phase/ Hertz	V/-/Hz	6600 / 3 / 50	400 / 3 / 50	400 / 3 / 50	400 / 3 / 50	400 / 3 / 50	400 / 3 / 50
F	Basic Scope of Supply							
F1	a. API 685 canned Motor Pump	-	Required	Required	Required	Required	Required	Required
F2	c. Auto Recirculation Valve(ARC Valve)	-	Required (Option)	Required (Option)	Required (Option)	Not required	Required (Option)	Required (Option)
F3	g. Steel baseplate	-	Required	Required	Required	Required or Not required	Required	Required
F4	h. Baseplate anchoring system	-	Required	Required	Required	Required	Required	Required
F5	i. All required instrumentation	-	Required	Required	Required	Required	Required	Required
F6	Base spare parts(Start-up, 2 years)	-	Required	Required	Required	Required	Required	Required
F7	Optional spare parts (Capital)	-	Required (Option)	Required (Option)	Required (Option)	Required (Option)	Required (Option)	Required (Option)
F8	Delivery to ITER site (DAP)	-	Required	Required	Required	Required	Required	Required
G	Environmental condition							
G1	Radiations	-	Yes	Yes	Yes	Yes	Yes	Yes
G2	Static Magnetic Field	-	Yes	Yes	Yes	Yes	Yes	Yes
G3	Fire case	-	Yes	Yes	Yes	Yes	Yes	Yes
H	Remarks							
H1	Other details	-	For further details, refer to Technical Spec (G2R52F)	For further details, refer to Technical Spec (G2R52F)	For further details, refer to Technical Spec (G42GE6)	For further details, refer to Technical Spec (G42GE6)	For further details, refer to Technical Spec (G42GE6)	For further details, refer to Technical Spec (G42GE6)

Technical Specifications (In-Cash Procurement)

Technical Specification for CVBD Charging Pumps (26CVBD-PL-5701 and 26CVBD-PL-5703)

This is a technical specification for procurement of CVBD Charging Pumps (26CVBD-PL-5701(CVBD Charging Pump 1) and 26CVBD-PL-5703(CVBD Charging Pump 2)) of CVBD system (=Chemical and Volume Control System (CVCS) for the Integrated Blanket, Edge Localized Mode/Vertical Stability, and Divertor Primary Heat Transfer System (IBED PHTS)).

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1 Preamble

This Technical Specification is to be read in combination with the General Management Specification for Service and Supply (GM3S) [d1] that constitutes a full part of the technical requirements. In case of conflict, the content of the Technical Specification supersedes the content of [d1].

2 Purpose

The Chemical and Volume Control System (CVCS) for the Integrated Blanket, Edge Localized Mode/Vertical Stability, and Divertor Primary Heat Transfer System (IBED PHTS) (hereinafter referred to as CVBD) provides control of IBED PHTS water chemistry and corrosion, removal of soluble and insoluble species from IBED PHTS water, assistance in controlling the IBED PHTS coolant inventory, and maintenance of the IBED PHTS volume through interface with the Draining and Refilling System. Two CVBD Charging Pumps (26CVBD-PL-5701 and 26CVBD-PL-5703) provide charging flow to the IBED PHTS to maintain and control coolant inventory. CVBD Charging Pump 1 is in operation during all CVBD operating modes (including baking mode, when it provides recirculation flow). CVBD Charging Pump 2 is in operation during baking mode only (Refer to Appendix F – Simplified CVBD PFD).

This Specification defines the material, design, fabrication, inspection, examination, testing, certification, qualification and preparation for delivery of the **Two (2) CVBD Charging Pumps (26CVBD-PL-5701 and 26CVBD-PL-5703)**. The pumps shall be canned motor pumps.

3 Acronyms and Definitions

3.1 Acronyms

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

Table 1 - List of Abbreviations

Abbreviation	Description
ACP	Activated Corrosion Products
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASN	Autorité de Sûreté Nucléaire (Nuclear Safety Authority)
ASTM	American Society for Testing and Materials
BPVC	Boiler and Pressure Vessel Code
CE	Conformité Européenne (European Conformity)
CMTR	Certificated Material Test Reports
CFD	Computational Fluid Dynamics
COTs	Commercial Off-Shelf
CRO	Contract Responsible Officer
DN	Nominal Diameter
DS	Datasheet
EDH	Electrical Design Handbook
EN	European Norm

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EP	Embedded Plates
ESPN	Equipments sous Pression Nucléaires (Nuclear Relate Pressure Equipment)
ESR	Essential Safety Requirements
E-stop	Emergency Stop
FRS	Floor Response Spectra
GM3S	General Management Specification for Service and Supply
IBED PHTS	Integrated Blanket/Edge Localization Mode/Divertor Primary Heat Transfer System
HVAC	Heating, Ventilation, and Air Conditioning System
I&C	Instrumentation and Control
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization
IO	ITER Organization
LCP	Local Control Panel
LV	Low Voltage
MAWP	Maximum Allowable Working Pressure
MCC	Motor Control Center
MTO	Material Take Off
MV	Medium Voltage
N/A	Not Applicable
NB/ANB	Notified Body/Agreed Notified Body
PCS	Plant Control System
PFD	Process Flow Diagram
PIA	Protection Important Activity
PIC	Protection Important Component
PLC	Programmable Logic Controller
PSS	Plant Safety System
PNI	Part Number Identification
PMI	Positive Material Identification
PQR	Procedure Qualification Record
PRO	Procurement Responsible Officer
QA	Quality Assurance
QC	Quality Class
ORP	Oxidation Reduction Potential
RCC-E	Design and Construction rules for Electrical and I&C Systems and Equipment
RCC-M	Design and Construction Rules for the Mechanical Components of PWR Nuclear Islands
RTD	Resistance Temperature Device
SC	Seismic Class

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SIC	Safety Important Class
SL	Seismic Level
SLD	Single-Line Diagram
SMHV	Séismes Maximaux Historiquement Vraisemblables (Maximum Historically Probable Earthquakes)
SR	Safety-Related
SRD	System Requirements Document
SSEN	Steady-State Electrical Network
TCWS	Tokamak Cooling Water System
TP	Terminal Point
TRO	Technical Responsible Officer
TTT	Function Category Designators
UCP	Unit Control Panel
WPS	Welding Procedure Specification
VAC	Volts Alternating Current
VDC	Volts Direct Current
VFD	Variable Frequency Drive
VV PHTS	Vacuum Vessel Primary Heat Transfer System

3.2 Definitions

Contractor: the economic operator who have signed the Contract in which this document is referenced, as defined in the Special Conditions of the said Contract.

CVBD Charging Pumps: complete scope of supply as defined in sections 2 and 5.1.

Inline connections: connections that are directly connected to piping. These flanges will be exposed to piping interface loads (bending/torsion moments and axial/transverse forces) and thermal expansion. This includes but is not limited to Suction and discharge flanged nozzles of pumps.

Main Skid: Common baseplate on Pumps will be installed.

Mandatory Template: model of document provided by IO that the Contractor shall use in order to submit the said document and which cannot be modified without the prior agreement of the IO.

Sub-Contractor: shall mean an economic operator who is under contract to a Contractor providing supplies, services or works to the IO, being understood that the subcontractor shall perform, under responsibility of the Contractor, with independence and free from any subordination, a specific part of the obligations of the Contract.

Supplier: a legally registered entity that can provide standard / catalog goods or material, or standard services to a Contractor, or a subcontractor, that will enable the performance of the scope of work to be provided by the Contractor or subcontractor. In the frame of this technical specification the term **sub-Supplier** is used considering the presence of a main Contractor.

Typical Template: model document provided by IO for information that the Contractor may use to submit this type of document.

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4 Applicable Documents & Codes and standards

4.1 Applicable Documents

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

Applicable version of references listed in [4.1.1](#) and [4.1.2](#) will be confirmed at the date of the Purchase Order.

Upon notification of any revision of the applicable document transmitted officially to the Contractor, the Contractor shall advise within 2 weeks of any impact on the execution of the contract. Without any response after this period, no impact will be considered.

4.1.1 References

Following ITER documents fully apply to the scope of supply.

Table 2 - Reference Requirements

Ref	Title	IDM ID	Version
[d1]	General Management Specification for Service and Supply (GM3S)	82MXQK	1.4
[d2]	Deleted	-	-
[d3]	Quality Classification Determination	24VQES	8.0
[d4]	TCWS IBED CVCS (CVBD) Hydraulic Sizing Calculation	WEP5KL	2.2
[d5]	TCWS CVCS IBED (CVBD) I&C Functional Requirements	Y5WJXX	1.1
[d6]	Allowable values and limits in service level C and D for ITER mechanical components	3G3SYJ	3.1
[d7]	TCWS Load Specification	SZE5MR	2.6
[d8]	Equipment Specification for piping materials used in the design of process piping systems	SJE6S7	3.1
[d9]	Assessment of TCWS effluents, influents, and chronical leaks	U7YB3K	4.0
[d10]	Collection of Input Data to support Qualification Plan in charge of TCWS electro-mechanical equipment Contractor	YST3YH	2.3
[d11]	Radiation Environment for Equipment During Operations	3FM52L	1.1
[d12]	PBS26 IBED CVCS piping ESPN Classification for XGXS95 v2.4	8PN9P3	2.1
[d13]	Impurity controls requirements for PBS26	9LPHJE	3.0
[d14]	Working Instruction for Foreign Material Exclusion	3SJJVJ	2.0
[d15]	Technical specification for Coating and Tagging	S9YVVG	1.0
[d16]	TCWS Equipment Insulation	XB5DLJ	2.2
[d17]	ITER Document: EDH Part 1: Introduction	2F7HD2	1.4
[d18]	ITER Document: EDH Part 2: Terminology & Acronyms	2E8QVA	1.5
[d19]	ITER Document: EDH Part 3: Codes & Standards	2E8DLM	1.3
[d20]	ITER Document: EDH Part 4: Electromagnetic Compatibility (EMC)	4B523E	3.0
[d21]	ITER Document: EDH Part 5: Earthing and Lightning Protection	4B7ZDG	3.0
[d22]	IO cable catalogue	355QX2	6.13
[d23]	Electrical Single Line Diagram (SLD) for CVCS BD	Y5YC8L	1.4

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Ref	Title	IDM ID	Version
[d24]	Deleted	-	-
[d25]	Deleted	-	-
[d26]	Deleted	-	-
[d27]	Function Category Designators (TTT code)	43WDW9	-
[d28]	ITER Numbering System for Components and Parts	28QDBS	5.1
[d29]	HIRA PBS26 Risk Assessment Table	S3GEWG	2.0
[d30]	Procedure for Indication and Control of Items	U344WG	2.2
[d31]	How To Request PNI - Catalogue Part	2NGCBV	2.1
[d32]	Deleted	-	-
[d33]	Lifting Instruction	YJ9MBD	1.10
[d34]	Deleted	-	-
[d35]	Package & Packing List Template	XBZLNG	2.2
[d36]	Delivery Report Template	WZPYVZ	3.0
[d37]	Template - Equipment Storage & Preservation Requirements Form	WU9636	4.3
[d38]	Deleted	-	-
[d39]	Deleted	-	-
[d40]	Deleted	-	-
[d41]	IO / In-Cash Contractor Documentation Exchange and Storage Working Instruction	G8UMB3	6.0
[d42]	Quality Requirements for IO Performers	22MFG4	6.4
[d43]	MQP L3 Working Instruction for the Qualification of ITER safety codes	258LKL	3.1
[d44]	Deleted	-	-
[d45]	Provisions for implementation of the generic safety requirements by the external actors/interveners	SBSTBM	2.3
[d46]	Order dated 7 February 2012 relating to the general technical regulations applicable to INB - EN	7M2YKF	1.7
[d47]	Procedure for management of non-conformities	22F53X	10.3
[d48]	Procedure for the management of Deviation Request	2LZJHB	9.1
[d49]	MQP L2 Propagation of the Defined Requirements for Protection Important Components Through the Chain of External Interveners	BG2GYB	3.3
[d50]	List of ITER-INB Protections Important Activities	PSTTZL	2.2
[d51]	EDH Guide A: Electrical Installations for SSEN Client Systems	2EB9VT	2.7
[d52]	Deleted	-	-
[d53]	Annex 2 - Detailed list of PIAs	Q8B5C4	1.2
[d54]	Qualification guidelines	WGFF3G	1.0
[d55]	Software Qualification Policy	KTU8HH	2.0
[d56]	MQP L3 Procedure for Qualification of Protection Important Components (PIC)	XB5ABP	2.1
[d57]	Test Method for ITER Equipment for Static (D.C) Magnetic Fields	98JL4W	3.6
[d58]	EEE Nuclear Radiation compatibility Handbook	XWYYL3	4.1

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Ref	Title	IDM ID	Version
[d59]	Safety Important Functions and Components Classification Criteria and Methodology	347SF3	1.8
[d60]	MQP L3 Working instruction for Manufacturing Readiness Review	44SZYP	5.1
[d61]	Design Seismic Floor Response Spectra in the Tokamak Complex	SVBRJZ	1.1
[d62]	Technical Specification for the Experimental Seismic Qualification of Active Electrical and Mechanical Components	AGL2QP	3.0
[d63]	Deleted	-	-
[d64]	Deleted	-	-
[d65]	I&C Design criteria document for TCWS - IBED PHTS, NBI PHTS, CVCS	Y6R3VX	1.4
[d66]	Guideline to manufacture NPE N2 or N3 cat 0 & PE cat 0	VHC4YM	1.3
[d67]	Guideline for the exclusion/exemption of equipment from the French regulation	35SVBG	2.6
[d68]	Total Neutron Flux	2UQTEE	1.4
[d69]	Working Instruction for the Delivery Readiness Review (DRR)	X3NEGB	3.0
[d70]	Instructions for Seismic Analyses	VT29D6	2.1
[d71]	Instructions for Structural Analyses	35BVV3	4.1
[d72]	IO Template of Qualification Synthesis Report	X3AUHZ	1.1
[d73]	Technical Specification for Coatings for Equipment	R45ME7	1.1
[d74]	Guidelines for qualification of mechanical equipment	ADCXXD	1.0
[d75]	Guidelines for qualification of I&C System and Software	AHNMBK	1.0
[d76]	Radioprotection guide for ESPN application	2LTQ96	2.5
[d77]	Safety I&C specifications for TCWS	RW54RB	5.4
[d78]	26CVBD-PL-5701_GA_DRW	GKE2JT	(Later)
[d79]	Technical Specification of PBS26 TCWS Sensors	4S4HMY	1.2
[d80]	HOW TO - Commercial Grade Dedication for ITER	6MKCJ6	1.0
[d81]	Procedure for Qualification of Commercial-Off-the Shelf Items in the ITER Project	4QPQRW	1.1
[d82]	Qualification Guidance - Typical Test Procedures	8548LP	1.2
[d83]	Guidelines for qualification of electrical and I&C equipment	ADD99Y	1.0
[d84]	Guidelines for Qualification by Analysis	AKFUMQ	1.2
[d85]	Procedure for Analyses and Calculations	22MAL7	6.9
[d86]	Instructions for the Storage of Analysis Models	U34WF3	2.0
[d87]	MQP L3 WI for Computational Fluid Dynamics (CFD) Analyses	VUEEDB	2.1
[d88]	26CVBD pressure vessels ESPN Classification Evaluation	YWWMY9	1.5
[d89]	26CVBD-PL-5703_GA_DRW	GKE2MC	(Later)
[d90]	Technical Specification for Specialty Valve(Lot 2)	YWDX46	1.4

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4.1.2 Source References

Source of reference are used to determine requirements given in this specification. They are supplied to Contractor and shall be used to detail requirements given in this document when referenced in the documents.

Table 3 - Source References

Ref	Title	IDM ID	Version
[r1]	WP8.2.2 Final Report of RAMI analyses for TCWS	Y5X8X2	7.1
[r2]	Technical Specification VV PHTS Volume Control Tank 26PHVV-TA-5001	XKDVFV	4.2
[r3]	TCWS - Equipment Nozzle loads	5VUUXW	2.0
[r4]	Load Specifications (LS)	222QGL	6.3
[r5]	Codes and Standards for ITER Mechanical Components	25EW4K	5.0
[r6]	TCWS CVBD System Process Loading Conditions	8PZBTB	1.0
[r7]	WP4.11.1 IBED CVCS Screening of the water hammer and hydraulic load cases	Y5X3FK	2.0
[r8]	Deleted	-	-
[r9]	TCWS IBED CVCS (CVBD) Piping & Instrumentation Diagram (P&IDs)	XGXS95	2.4
[r10]	SRD-26-PH,-CV,-DR,-DY (TCWS) from DOORS	2823A2	7.0
[r11]	Deleted	-	-
[r12]	Anticipated use of 2020 radiation maps for TCWS major components	4655X7	1.0
[r13]	Deleted	-	-
[r14]	Magnetic Field Map Database Query Tool User Manual	53KMVD	1.4
[r15]	Practical approach in TCWS regarding fire event scenario	WRW2TW	1.4
[r16]	TCWS IBED CVCS (CVBD) Design Conditions Calculation	94HGS3	2.2
[r17]	Deleted	-	-
[r18]	Deleted	-	-
[r19]	Deleted	-	-
[r20]	Deleted	-	-
[r21]	Static and transient magnetic field maps at level L4 tokamak complex	QUDEGC	1.2
[r22]	CE Marking - Awareness	YPL6P6	2.1

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4.2 Applicable Codes and Standards

It is the responsibility of the Contractor to procure the relevant Codes and Standards applicable to this scope of work (, also refer to [r5]).

Unless designated specifically by Laws and Regulations, latest revision of code and standards shall be applicable at the date of Purchase Order.

Table 4 - Applicable Codes and Standards

Ref	Title	Edition /Year
[s1]	API 685 - Sealless Centrifugal Pumps for Petroleum, Petrochemical, and Gas Industry Process Service	3rd
[s2]	Deleted	-
[s3]	Deleted	-
[s4]	Deleted	-
[s5]	API RP 686 – Recommended Practice for Machinery Installation and Installation Design	2nd
[s6]	ASME B 16.5 – 2013 Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard	2013
[s7]	ASME Boiler and Pressure Vessel Code, Section II, Materials	2023
[s8]	ASME Boiler and Pressure Vessel Code (BPVC) - Section V-Non Destructive Examination	2023
[s9]	ASME Boiler and Pressure Vessel Code (BPVC) - Section VIII-Rules for Construction of Pressure Vessels Division 1 and Division 2	2023
[s10]	ASME Boiler and Pressure Vessel Code (BPVC) - Section IX-Welding, Brazing, and Fusing Qualifications	2023
[s11]	ASME B 16.5 – 2013: Standard for Steel Pipe Flanges and Flanged Fittings.	2013
[s12]	ASME B31.3-2010. Process Piping	2010
[s13]	ASME B36.19M : Stainless Steel Pipe	2004
[s14]	ASME NQA-1-2012, Quality Assurance Requirements for Nuclear Facility Applications.	2012
[s15]	ASME PTC – 19.1 – 2018, Test Uncertainty	2018
[s16]	ISO 21940-1:2016 1 - Mechanical vibration — Rotor balancing — Part 11: Procedures and tolerances for rotors with rigid behaviour	2016
[s17]	ISO 9906 – 2012: Rotodynamic Pumps – Hydraulic Performance acceptance tests Grade 1, 2, 3	2012
[s18]	ISO 10816-3 – 2004: Mechanical vibration - Evaluation of machine vibration by measurements on non-rotating parts	2004
[s19]	ISO 9001: Quality management systems — Requirements	2015
[s20]	ISO 3744: Acoustics — Determination of power levels and sound energy levels of noise sources using sound pressure	2010
[s21]	RCC-E - 2019, Design and Construction rules for Electrical and I&C Systems and Equipment	2019
[s22]	RCC-M -2017, Design and construction rules for mechanical components of PWR nuclear islands (for reference only)	2017
[s23]	EN 10204 – 2004: Metallic Products – Types of Inspection Documents	2004

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Ref	Title	Edition /Year
[s24]	EN 1591-1 – 2013: Flanges and Their Joints – Design Rules for Gasketed Circular Flange Connections – Part 1: Calculation.	2013
[s25]	EN 55011: Industrial, Scientific And Medical Equipment – Radio-Frequency Disturbance Characteristics – Limits And Methods Of Measurement	2016
[s26]	EN ISO 9712: Qualification and certification of NDT personnel	2012
[s27]	SNT-TC-1A: Personnel Qualification and Certification in Nondestructive Testing	2020
[s28]	IEC 60034 – all parts– 2017: Rotating Electrical Machines, all parts	2017
[s29]	IEC 60072 – 1 – 2022: Dimensions and output series for rotating electrical machines	2022
[s30]	IEC 61000 – 3 – 2021: SER, Electromagnetic compatibility (EMC) - Part 3: Limit - ALL PARTS	2021
[s31]	IEC 61000 – 4 – 2020: Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques – ALL PARTS	2020
[s32]	IEC 60068 – 2 – 2021: Environmental testing - Part 2: Tests - ALL PARTS	2021
[s33]	IEC 61226: Nuclear power plants - Instrumentation, control and electrical power systems important to safety - Categorization of functions and classification of systems	2020
[s34]	IEC 60947 – All Parts - Low-voltage switchgear and control gear	2020
[s35]	ASTM A380 / A380M – 17: Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems	2017
[s36]	ASTM A802 / A802M – 10 2010, Standard Practice for Steel Castings, Surface Acceptance Standards, Visual Examination	2010
[s37]	ASTM E165 / E165M – 18, Standard Practice for Liquid Penetrant Testing for General Industry	2023
[s38]	ASTM A802-19: Standard Practice for Steel Castings, Surface Acceptance Standards, Visual Examination	2019
[s39]	Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH),	2006
[s40]	The 'Blue Guide' on the implementation of EU product rules	2022
[s41]	IEC 60085:2007 - Electrical insulation - Thermal evaluation and designation	2007
[s42]	ISO 3746:2010 – Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure – Survey method using an enveloping measurement surface over a reflecting plane	2010
[s43]	ISO/IEC 17025:2017 - General requirements for the competence of testing and calibration laboratories	2017
[s44]	ASME QME-1 - Qualification of Active Mechanical Equipment Used in Nuclear Facilities	2023
[s45]	IEC-61000 Electromagnetic compatibility (EMC)	2016
[s46]	IEC/IEEE 60980-344:2020 - Nuclear facilities - Equipment important to safety - Seismic qualification	2020
[s47]	Deleted	-

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It is Contractor's responsibility to apply all Laws and Regulations that concerns the scope of supply in the Manufacturing Location and in the Installation Country (France). The list included here below is given **for information only**:

- a. Regulation (EU) 2023/1230 of the European Parliament and of the Council of 14 June 2023 on machinery and repealing Directive 2006/42/EC of the European Parliament and of the Council and Council Directive 73/361/EEC,
- b. Directive 2014/68/EU of the European Parliament and Council of 15 May 2014 on the harmonisation of the laws of the member states relating to the making available on the market of pressure equipment (PED),
- c. Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility (recast) (known as the EMC Directive),
- d. Directive 2014/35/EU of the European Parliament and Council of 26 February 2014 on the harmonization of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits (recast). (known as the Low Voltage Directive),
- e. French Order dated 30 December 2015 for Nuclear Pressure Equipment (ESPN), modified by order dated 03 September 2018.
- f. French environment code, Articles L557 and R557 (Transposition of PED 2014/68/UE in French law)

4.3 Conflicting Requirements

- a. Order of Priority of Applicable documentation, Codes and Standards is listed here below (from higher to lower):
 - i. Laws and Regulation:
 - French Nuclear Safety Authority (ASN) requirements,
 - European Directives and Regulations,
 - All other Legislations and Directives for nuclear facility in France,
 - ii. This Technical Specification,
 - iii. Applicable Codes and Standard (refer to section 4.2) and Applicable Documents (refer to section 4.1).
- b. Contractor shall highlight conflicting requirements and information to seek clarification from IO. Conflicts between documents or a lack of information in this Technical Specification shall not relieve the Contractor from his responsibility of supplying the equipment correctly designed, manufactured and tested according to his own experience and for the specified operating conditions.
- c. All requirements included in the applicable documentation are binding for the Contractor.
- d. Any deviation to contractual documentation should be submitted by Contractor to IO during tendering process. Approved deviations shall be incorporated in applicable documentation included in Purchase Order.
- e. Any deviation raised after Purchase Order shall be timely submitted by Contractor to IO Approval.
- f. No work or action related to the approval of the deviation shall be performed without written acceptance by IO.
- g. Deviations presented after Purchase Order shall always indicate the cost and schedule reduction for the Contractor related to its acceptance, compared to the implementation of the contractual requirement.

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5 Scope of Work

The Contractor is responsible for complete design, qualification, manufacturing, inspection, testing, performance, painting, packing, loading, safe delivery to ITER of the scope of work defined here below.

The Contractor is responsible to determine the detailed scope of supply that envelope the requirement of this section and to make sure that the equipment functional and operational requirements are met satisfactorily.

5.1 Scope of Supply

The scope of supply is composed by 2 Pumping Trains as defined here below:

- a. Pump, Motors and accessories to be installed on Main Skid (refer to section [5.1.1](#))
- b. Deleted
- c. Equipment installed off-skid or shipped loose (refer to section [5.1.3](#))
- d. Spare parts and special tools (refer to section [5.1.4](#))

5.1.1 Equipment installed on Main Skid

Each of 2 CVBD Charging Pump main skids shall include:

- a. One API 685 canned Motor Pump
- b. One canned motor equipped with required power and instrumentation junction boxes and cable glands (MV motor for 26CVBD-PL-5701 and LV Motor for 26CVBD-PL-5703)
- c. One Auto Recirculation Valve(ARC Valve) and One Back Pressure Valve(BP Valve) (Option)
- d. Deleted
- e. Deleted
- f. Deleted
- g. Steel baseplates covering all equipment installed on-skid with necessary lifting provision (refer to section [9.5.7](#) for required configuration of baseplates)
- h. Baseplate anchoring system with levelling provision such as levelling screws and/or stainless steel shim plates, counter plates, intermediate frames, bolting, template (for fixing anchor bolt locations)
- i. All required instrumentation for safe and reliable operation of the machine at least including instrument specified in [Appendix A1](#) and [Appendix A2](#)
- j. Instrumentation junction boxes with stanchions & cable glands
- k. Deleted
- l. One power terminal boxes for each voltage level utilized
- m. Instrumentation cables and electrical cables with cable/conduits or cable trays within the battery limits
- n. All interconnecting piping, including cooling arrangements (when mandatory), valves and fittings up to skid edge
- o. Deleted
- p. Isolation valves for all terminal points
- q. Personnel protection for all hot surfaces
- r. Counter-flanges (with weld neck) for suction and discharge nozzles and for all other terminal points along with gaskets, bolts, nuts and washers
- s. Removable emergency stop push button with stanchion & cable gland
- t. Two on-skid earthing lugs in opposite position (internal grounding of components to baseplate shall be realized by Contractor)
- u. Stainless steel name plates & labels

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- v. Stainless Steel Cladding installed above heat/fire insulation
- w. Surface preparation, shop painting and corrosion protection up to final painting
- x. Painting material for touch-up painting at site
- y. Seaworthy long-term packing and preparation for Shipment (refer to section 13.4)

5.1.2 Deleted

5.1.3 Additional Equipment installed off-Main Skid or supplied loose

The Contractor shall include the following equipment installed off-skid or shipped loose:

- a. Any additional equipment required by the qualification strategy of the scope of supply (including all required sample equipment to be used in qualification testing, up to a complete test skid when required),
Flow straightener or equivalent devices to cope with the process piping layout (refer to section 9.4.3), in case that suction piping straight length recommended by Contractor is not achieved by IO. If not integrated in pump casing, flow straightener shall be supplied by Contractor together with the portion of process piping starting from pump flange and including the complete pipe length in which the device will be installed.

5.1.4 Spare Parts and Special Tools

- a. Contractor shall include all the necessary commissioning and start-up spares and essential 2 year spares in their scope of supply, as described below.
 - i. Commissioning and start-up spares are those spares which may be required during commissioning and start-up. All spares used until the process units are fully commissioned and started-up shall come under this category. As a minimum, spares in Table 5 shall be provided. Contractor shall identify all additional commissioning and start-up spares for selected models of equipment and supply them along with main supply. A final commissioning and start-up spare list shall be submitted by Contractor.
 - ii. Essential 2 year spares are those spares which are considered necessary for two (2) years of normal plant operation. **Minimum essential 2 year spares, to be supplied by the Contractor as part of the base scope of supply, are listed in**
 - iii. Table 6.

Table 5 - Commissioning and Start-up spares

Spare-Parts Description	Unit for Spares	26CVBD-PL-5701	26CVBD-PL-5703
Pump Gaskets, shims, O-rings	Sets	2	2
Wear rings (for Pump casing & Impeller)	Sets	1	1
Auxiliary impeller (if applicable)	Sets	1	1
Bearings	Sets	1	1
Bolts, nuts & washers for each flanged connection	Sets	1	1
Gaskets for each flanged connection	Sets	3	3
Any additional commissioning and start-up spares defined by Contractor	Sets	TBD by Contractor	TBD by Contractor

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Table 6 - Essential 2 year spares

Spare-Parts Description	Unit for Spares	26CVBD-PL-5701	26CVBD-PL-5703
Same spares/quantity specified in Table 5	Sets	1	1
(Instrument spares)			
Leakage detector switch (API 685 3rd 7.4.2.1 b)	Nos.	1 per type	1 per type
Motor stator winding RTDs (API 685 3 rd 9.2.2.12)	Nos.	2 per type	2 per type
Temperature RTD for stator liner, containment shell or returned circulation fluid (API 685 3 rd 7.4.2.1 c)	Nos.	2 per type	2 per type
Vibration sensor (API 685 3 rd 6.9.8)	Nos.	2 per type	2 per type
Bearing wear detector (API 685 3 rd 9.2.5)	Nos.	1 per type	1 per type
Any additional 2 year spare parts defined by Contractor	Sets	TBD by Contractor	TBD by Contractor
All additional spare parts that Contractor considers necessary after 2 years interval of operation, including components to be replaced due to their qualified life in the applicable environmental conditions.	Sets	TBD by Contractor	TBD by Contractor

Notes:

- One set means quantity required for full replacement of the respective part of one Pump. Total Quantities to be confirmed by Contractor.
- All spares supplied for 26CVBD-PL-5701 and 26CVBD-PL-5703 should be physically and technically interchangeable as much as possible.

b. Deleted

- c. Capital Spares are parts that are normally not required during normal operation for their long life or reduced risk of failure, but that, in case of failure, would cause shutdown of equipment for a prolonged period because of the long lead time. The Contractor shall furnish a list of Capital Spares parts. The list shall be complete with quantities and unit prices. The IO shall have the option to increase or decrease the quantities of spare parts as required. **Capital Spares are not included in the base scope of supply.** The IO will provide separate order for the Capital Spares that might be selected.

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- d. Supplied spare part shall be furnished with same quality requirement and testing level of the main equipment. Dedicated manufacturing and inspection plan (MIP) shall be supplied.
- e. The Contractor shall also furnish special tools required for handling, maintenance and repair of the components of Pump. The Contractor shall supply all tools and tackles clearly marked with its size and/or purpose. They shall be packaged in separate, rugged metal boxes and marked “special tools for (tag/item number). Special tools shall include as a minimum the items included in [Table 7](#).

Table 7 – Special Tools

Special Tool Description	Unit	26CVBD-PL-5701	26CVBD-PL-5703
Special tools required to dismantle, assemble, and/or maintenance the pump	Sets	1	1
Any additional tool required by the installation procedure that will be agreed in detailed engineering phase	Sets	1	1

5.2 Scope of Services

- a. Meetings (including travel and accommodation expenses for Contractor personnel):
 - i. Kick-off Meeting at IO's office
 - ii. Pre-Inspection Meetings related to Manufacturing Readiness Review (MRR) at supplier's office
 - iii. Engineering meetings at IO's office or Contractor's office
 - iv. Other Design Review and Contract Reviews as required by Project Gates (refer to section [17.2](#))
- b. All Project Documentation as required in section [18](#)
- c. Complete assembly of the scope of supply as per approved project drawings,
- d. Installation of Heat Insulation/Heat Tracing/Fire Insulation/Personnel protection with cladding,
- e. Safe delivery to ITER Site (DAP to ITER Site in Saint-Paul-lez-Durance, France),
- f. All required NDTs with certificates as per approved MIP,
- g. Services of Third Parties as required by applicable Laws and Codes,
- h. Factory and Acceptance Test activities with certificates,
- i. Qualification Documentations, Testing and Certificates,
- j. All calculation notes and analysis required to certify the suitability of the machine to withstand operating and accidental conditions. Analysis Models shall also be submitted as per section 7.4 of [\[d1\]](#).
- k. Assistance to Installation and Start-up, attendance to Site Acceptance Tests. This shall include personnel specialized on equipment supplied on Main Skid and Auxiliary Skids.

5.3 Exclusions

The followings are excluded from Contractor scope of supply:

- a. Electrical cables from on-skid Junction Boxes to Power Supply
- b. Instrumentation cables out of skid battery limit
- c. Deleted
- d. Deleted

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- e. Piping to be welded to counter-flange of all Terminal points (except suction and discharge flanges (refer to 5.1.3))
- f. Materials of Heat Insulation/Heat Tracing/Fire Insulation (refer to 9.6.7)
- g. Deleted
- h. Fire Fighting System
- i. Civil Works and Concrete Foundations

5.4 Contractor Quote request

The Contractor shall provide following separate quotes as indicated below:

- | | |
|----------|---|
| Quote #1 | Supply of 2 (two) CVBD Charging Pump Units and their auxiliaries (refer to sections <u>5.1.1</u> , <u>5.1.3</u> and applicable part of <u>5.2</u>) |
| Quote #2 | Base spare parts (Commissioning and start-up spare, Essential 2 year spares (refer to section <u>5.1.4.a</u>)) and special tools (refer to section <u>5.1.4.e</u>) |
| Quote #3 | Optional spare parts (Capital (refer to section <u>5.1.4.d</u>)) |
| Quote #4 | Assistance to Installation, Start-up, SATs (refer to section <u>5.2.k</u>). |
| Quote #5 | ARC Valves and BP valves (refer to section <u>9.5.8</u>) |

5.5 Delivery Time

Final agreed delivery date will be indicated in the Purchase Order (while currently expected delivery date to ITER Site is **October 11th, 2030**). Contractor shall put in place all required expediting actions for project completion in advance to the contractual delivery date to insure a reasonable schedule margin for shipping readiness. When the shipment is ready earlier than the final agreed delivery date, Contractor shall keep their equipment in their storage with proper long term preservation as a part of Contractor's scope. No shipment to ITER site earlier than the final agreed delivery date is allowed unless otherwise officially instructed differently by IO.

6 Location for Scope of Work Execution

List of Location where main manufacturing activities will be performed shall be indicated in the Contractor Proposal.

This should include as a minimum the following activities:

- a. Pump pressure casing manufacturing
- b. Pump Assembly and Testing
- c. Motor Manufacturing
- d. Skid Packaging
- e. Deleted
- f. Deleted
- g. Testing location.

The sub-contractors and sub-suppliers list, submitted for approval to ITER after the order, shall include the final location for work execution of each sub-contractor.

Change of one of location above shall be timely notified to IO.

7 IO Documents & IO Free issue items

7.1 IO Documents:

No input document is expected from IO, except applicable documentation listed in sections 4.1.

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7.2 Free issue items:

Fire insulation material will be supplied by ITER to Contractor for installation on the concerned equipment. Refer to section [9.6.7](#).

8 Equipment Classification

Table 8 - Equipment Classification

PIC/Safety Class (Note a)	SIC-1 for confinement only
Quality Class (Note b)	QC-1
PED Class (Note e, f)	Request for exclusion to be submitted by Contractor for pump casing and ARC valve (& BP valve)
	PED applicable to all auxiliaries
ESPN Class (Note e, f)	Main process pipe: Class N2
	Request for exclusion to be submitted by Contractor for pump casing and ARC valve (& BP valve)
	Auxiliaries connected to casing: Contractor shall apply French ESPN decree (refer to section 0) to determine applicability of ESPN and the related classification.
Seismic Class (Note c, d)	Pump : SC-1(S), ARC Valve (& BP valve) : SC-1(SF)
Vacuum Class	N/A
Tritium Class	N/A
RH Class	N/A
Export Control	N/A

NOTES:

- a. SIC-1 identifies systems and component that are required to bring and maintain ITER in a safe state.
- b. Quality Class QC-1: QC-1 is defined as per Quality Classification Determination, refer to [\[d3\]](#). The requirements from application of quality Class 1 as per Quality Requirements for IO Performers [\[d42\]](#) applies.
- c. Seismic Class SC1 (S): Structural stability maintained in the event of a SL-2 level earthquake, i.e. no rupture of piping, no collapse of structures or equipment, limited plastic strain, limited concrete cracking, structural support functions maintained. With this level of requirement, it is possible that a small level of deformation could occur. Consequently, it could be necessary to inspect equipment before re-using it. However, no radioactive water leak shall occur. Additionally, no shaft seizure shall occur to Pump when exposed to an SL-2 Earthquake (Refer to section [9.3.3.g&h](#)).
- d. Seismic Class SC1 (SF): Structural stability and required functional seismic safety performance maintained in the event of an earthquake, the respect of this level of requirement guarantees the level of safety as throughout the normal operation of the equipment. Nevertheless, taking into account seismic load characteristics, fatigue is not taken into account.
- e. Contractor can refer the “Guide to the implementation of directives based on the New approach and the global Approach” (see reference [\[s40\]](#)), or may hire consultant if required, to ensure that all applicable European directives and regulations are complied.

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- f. Contractor shall demonstrate applicability of Exclusion to PED Directive 2014/68/EU (and consequently to ESPN) for pump pressure casing and ARC valve (& BP valve), as allowed by Article 1 Section 2 (j) of the directive. In this section it is stated that is excluded from the range of applicability of the directive:

Equipment comprising casings or machinery where the dimensioning, choice of material and manufacturing rules are based primarily on requirements for sufficient strength, rigidity and stability to meet the static and dynamic operational effects or other operational characteristics and for which pressure is not a significant design factor. Such equipment may include:

- *Engines including turbines and internal combustion engines,*
- *Steam engines, gas steam turbines, turbo generators, compressors,*
- *Pumps and actuating devices.*

A demonstration of applicability of this clause shall be submitted to IO for approval.

Document in reference [d67] gives guidelines for the request of exclusion from French Regulation.

- g. Nevertheless, all other auxiliary pressure equipment in Contractor scope shall follow the PED/ESPN classification as stated by the directive. Guidelines given in [d76] should be applied in the eventuality of application of ESPN directive to equipment included in the scope of supply.
- h. Document in reference [d66] gives the guidelines for the application of Sound Engineering Practice usable by any manufacturer of Category 0 Pressure Equipment and Nuclear Pressure equipment to be installed in IO.

8.1 CE Markings

- a. "CE" marking is required for units in the frame of Machinery Regulation 2023/1230. A declaration of conformity, as per Annex V - Part A of the regulation, shall be drawn up and signed certifying that Pump comply with the "Directive of the European Parliament and the Council".
- b. Declaration of conformity, the instruction and operational manuals and all other documentation required by applicable Directives, shall be provided in two languages – English and French.
- c. Contractor shall include required certification to all other applicable European Directives and apply the CE marking to equipment installed on Main Skids and all the auxiliary equipment installed out of Main Skid or supplied loose, including spare parts and special tools.
- d. In the framework of CE marking, Contractor is considered as the "manufacture" and carried associated responsibilities, meanwhile IO is the end-user only. Contractor shall follow Appendix G – General instructions for CE Marking.

9 Construction Requirements

9.1 General Requirements

- a. Pump shall be designed, fabricated, inspected and tested in accordance to API 685 3rd edition [s1] with supplemental requirements given in this Specification.
- b. Pump shall be designed for a commissioning period of 5 years and an operating life of 20 years under the operational requirements and the applicable loading conditions

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defined within this Specification and associated Appendices. This shall be demonstrated by Calculation notes and, when required, by testing.

- c. Applicable loading conditions are listed in Appendix C – Process Loading Conditions.
- d. The seismic loads applicable to the main skid and to the auxiliaries are defined in Appendix E – Seismic Loads.
- e. Any deviation to required operational life shall be clearly stated by Contractor before Purchase Order.
- f. Proposed pumps hydraulic design shall be proved and referenced (reference list to be supplied by Contractor with the Proposal).
- g. Non-cooling water type is strongly recommended for these canned motor pump. In case that Contractor shall use cooling water to fulfil the applicable loading conditions, Contractor shall clearly state it in the Proposal, seeking for IO Approval.

9.2 Reliability and Maintenance Requirements

- a. Secondary Equipment and subcomponents other than consumables, that are not demonstrated to achieve the required design life without replacement, shall be designed with a replacement interval of no less than 24 months.
- b. Pump programmed maintenance intervals shall be of no less of 24 Months to be in line with plant planned maintenance intervals.
- c. Pump and its auxiliary shall be accessible easily for maintenance, operation, inspection and/or repair, without sacrificing any safety aspect. The required clearance for disassembly of pump shall be clearly marked on the pump layout drawings and shall be agreed with IO considering plant layout.
- d. The design of Pump shall achieve the reliability values listed in Table 9 [r1]. These values are referred to the full scope of supply defined in this specification. Contractor shall submit a RAMI study to demonstrate compliance to these values. If these values cannot be achieved, an alternate value and basis for that value shall be provided to IO to determine the impact on the overall availability of the TCWS.
- e. Contractor shall include in the RAMI analysis all provision required to meet the required Mean Time to Repair. This shall be in line with indications given in the Installation, Operation and Maintenance manual.
- f. Contractor shall clearly state in the Operation and Maintenance Manual the predictive maintenance schedule (including forecasted wear parts replacement) to be implemented to guarantee the required design life. Contractor shall clearly state in the Proposal any eventual capital spare required to reach these targets.

Table 9 – Pump Allowable Failure Rates

Failure Mode	Failure Rate	Mean time to Repair (hours)
Failure to Start (FTS)	1.08·E-3/day	22
Failure to Run (FTR)	3.79·E-6/hour	145
Pump Pressure Boundary Leakage (including the definitions of External Leakage Small (ELS) External Leakage Large (ELL))	2.91·E-7/hour	22

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9.3 Operating Conditions

9.3.1 Process Configuration

- a. Deleted
- b. Process Fluid Parameters and Composition, including values of radiations and static magnetic field, are included in [Appendix A1](#) and [Appendix A2](#).
- c. Deleted
- d. Deleted
- e. Deleted
- f. Pump shall be capable to work to all process fluid temperature defined in [Appendix A1](#) and [Appendix A2](#) and in the transients defined in [Appendix C – Process Loading Conditions](#).
- g. No permanent strainer is foreseen in pumps inlet lines. A temporary strainer is present on pump suction line for commissioning.
- h. Pump shall be able to run with no impact on its performance and its reliability with the solid particle parameters specified in [Appendix A1](#) and [Appendix A2](#).
- i. The load categories I, II, III and IV and the Service Levels A,B,C,D are defined in [Appendix C – Process Loading Conditions](#).
- j. [Appendix A1](#) and [Appendix A2](#) and [Appendix C – Process Loading Conditions](#) define the Applicable Environmental Conditions in normal and degraded (DEG) cases.
- k. Available Utilities are indicated at page 6 of [Appendix A1](#) and [Appendix A2](#).
- l. Pump is exposed to Environmental Radiations and Static Magnetic field during the normal operation. Refer to page 6 of [Appendix A1](#) and [Appendix A2](#) for expected level of radiations and magnetic field.

9.3.2 Performances in Load Condition Category I and II

- a. Pump shall deliver the performance required in the CVBD system operating (refer to [\[d4\]](#)), corresponding to Service Level A. Brief explanations of pump operation are as below.
 - CVBD charging pump 1 (PL-5701) is dedicated for plasma/standby operation and CVBD charging pump 2 (PL-5703) is dedicated for operation during the IBED PHTS water baking operation.
 - During transition from plasma/standby operation to water baking operation and vice versa, both pumps (PL-5701 and PL-5703) are expected to operate in parallel for a short period (such as several minutes) while discharging into a common header. For detailed explanations of the transition operation, refer to Appendix B of reference [\[r6\]](#).
 - CVBD Charging pump 1 (PL-5701) is used in conjunction with makeup control valve VC-5764 and recirculation control valve VC-5728. CVBD Charging pump 2 (PL-5703) is used in conjunction with makeup control valve VC-5763. These charging pumps are constant speed pumps with different head and flowrate requirements; they are not redundant.
- b. Detailed Operating Parameters of each operating Case are defined in [Appendix A1](#) and [Appendix A2](#) and in [\[d5\]](#).
- c. The preferred operating region of Pump shall be as a minimum in the range from 70% to 120% of best efficiency flowrate. Preferred and allowable operating region shall be clearly identified on pump performance curve.

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- d. Rated flow should be within the region of 80–100% of best efficiency flowrate. Deviations to this requirement shall be submitted to IO for approval.
- e. Deleted
- f. Deleted
- g. The head curves shall be continuously rising to shutoff. Using a discharge orifice for achieving this is not preferable.
- h. Discharge pressure at shut off head (including maximum test tolerance), maximum fluid density and maximum suction pressure shall be limited to piping design pressure (5.9 MPaG (=6.0 MPaA)). Maximum Shutoff head (including all test tolerances) shall be in line with these requirements (Refer to 12.1).

Discharge pressure = Shut off Head (with max density) x test tolerance + max suction pressure

- i. The pump rotor / bearing dynamic system shall be stable under all operating conditions. The pump design shall permit continuous operation at any point in the operating range from minimum stable flow to end of curve flow. The end of curve flow is defined as minimum 120 % of the best efficiency flowrate.
- j. Allowable Operating Region, Preferred Operating Region, Minimum Stable Continuous Flow shall be explicitly declared by Contractor and plotted on the performance curves.
- k. The sound pressure level measured on all point at 1 m from the main skid shall be less 85 dBA (including test tolerances). This requirement applies to all skids and accessory equipment that will be supplied within the scope of this technical specification.
- l. The Contractor shall provide the allowable number of starts of Pump assemblies to IO for review during the design phase. The number of starts shall not exceed the fatigue limit of the material and shall be in compliance with the number of cycles given in Appendix C – Process Loading Conditions.
- m. Pump Pressure Boundary integrity shall be guaranteed to meet the CVBD safety function, refer to section 9.5.1.
- n. Leakage rates as defined in section 9.5.1 shall be guaranteed.
- o. Stability, Integrity and Functionality of Pump and of all its auxiliaries shall be guaranteed when exposed to A/B Service level Nozzle Loads and Category I and II loading conditions.

9.3.3 Performances in Load Condition Category III and IV

- a. Following service level applies to Pump and their accessories:
 - i. Service level C is required for Load Conditions Category III
 - ii. Service level D is required for Load Conditions Category IV
- b. Pump shall be designed to meet all load combinations as Appendix C – Process Loading Conditions and in TCWS Load Specification [d7] with consideration of guidelines on Allowable Values and Limits given in [d6].
- c. Deleted
- d. Stability of Pump and of all auxiliaries shall be guaranteed when exposed to C/D Service level Nozzle Loads and Category III and IV loading conditions.
- e. Pump Pressure Boundary integrity shall be guaranteed to meet the CVBD safety function (refer to section 9.5.1) when exposed to C/D Service level Nozzle Loads and Category III and IV loading conditions. Leakage rates included in sections 9.5.1 shall be guaranteed.
- f. The design shall include the equipment supports such as saddles and the anchoring system.

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- g. Pump shall be qualified to withstand a SL-2 seismic event, In line with Seismic Classification of the Pump (refer to section 8). The envelope SL-2 FRS with 3% damping factor for Pump location is given in Appendix E – Seismic Loads.
- h. The Contractor shall demonstrate that shaft seizure will not occur in any of the load Appendix C – Process Loading Conditions, including the case in which Pump are in operation when a seismic event up to Seismic Level 2 (SL-2) occurs. Pump seizure is also considered as initiating event in category III and IV to evaluate loads generated by the subsequent water hammer (refer to 7).
- i. The fire case is considered as a Category IV event (highly improbable situation): SL-2 seismic event followed by a fire event which is not concomitant shall be considered. The Maximum Historically Probable Earthquake (SMHV), as an aftershock, concomitant with the fire, shall be also considered for Pump.

9.4 Installation interfaces

9.4.1 General Installation Requirements

- a. API RP 686 5 should be used as a guideline for the configuration of the installation of Pump. All the additional requirements included in this specification apply.
- b. Static and dynamic loads transmitted from the baseplate to the foundations shall be clearly indicated in the foundation drawings or in a dedicated calculation note.
- c. A modal analysis of the vibration solicitations induced by Pump operation on the foundations, in comparison with building modal analysis (to be provided by IO during detailed engineering phase), shall be submitted by Contractor to IO for approval. Contractor shall adapt the design of the skid to avoid any possible dynamic interaction with the civil works.
- d. The design of supports for the installation of the insulation described in section 9.6.7 is included in the design and construction of Pump. Contractor shall include the space reservation required for the installation of the insulation material. The attachments of the insulation material shall be designed to withstand all loading conditions defined in Appendix C – Process Loading Conditions.
- e. Pump and its heavy individual components shall be provided with handling/lifting lug(s) that shall be clearly identified and designed as per following requirements:
 - i. Each handling/lifting lug shall be designed to support minimum 125% of the dry weight of Pump,
 - ii. Pump, the main sub-assemblies and all heavy-subcomponents shall not be lifted utilizing a single handling/lifting lug,
 - iii. The material tracing requirement and the inspection level for the lifting lugs shall be equivalent to those of the pressure boundary materials.
- f. Contractor shall indicate in the construction drawing the center of gravity of the entire skid (wet & dry), of the main sub-assemblies and of the heavy individual components.
- g. An installation procedure that considers the specific installation zone shall be submitted to IO for approval.
- h. Contractor shall submit 3D model data every time together with General Arrangement Drawing, satisfying the requirements below. The contents of the General Arrangement Drawing and the STEP file shall be consistent.
 - File Format : STEP (*.stp or *.step)
 - Model Type : Solid model (surface models are not accepted)
 - Model Tree : Well-structured model tree with an appropriate feature hierarchy
 - Model Scope : All contractor scope, including auxiliary component

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9.4.2 Space Reservation

- a. Location of equipment included in this scope of supply is given in Appendix D – Installation Data and Drawings.
- b. The dimensions and total weight of Pump and of all required auxiliaries shall not exceed the values given in Appendix D – Installation Data and Drawings. Contractor shall state in the proposal the fulfilment of this requirement. In case the dimensions and/or total weight of Pump are expected to exceed those values given, Contractor shall clearly indicate this information to IO in the bid phase.
- c. Any maintenance space required to access the equipment or to dismantle minor components shall be compatible with installation area. This shall be included by Contractor in the general arrangement drawings and agreed with IO.
- d. Deleted
- e. Loading, lifting and handling drawings/procedures shall be submitted to IO for approval.
- f. Any deviation to agreed footprints shall be submitted to IO for approval as soon as possible and with sufficient notice before start of manufacturing.

9.4.3 Piping interfaces

- a. Table 10 identifies the configuration of piping connections to terminal points. Applicable piping specifications codes are referred to Equipment Specification for piping materials used in the design of process piping systems [d8]. Piping installed within Contractor battery limits can follow Contractor piping classes, given that the applied design conditions are equal or higher than the design condition of the applicable piping classes. However, Contractor shall guarantee the full compatibility to IO piping classes at the interface.
- b. Following requirement shall apply:
 - i. Piping and piping connections shall be in accordance with ASME B31.3 [s12] Category M Fluid Service.
 - ii. Flanges shall be in accordance with ASME B16.5 [s11].
 - iii. The dimensions of all nozzles shall conform to ASME B36.19M [s13] metric dimensions.
- c. Any deviation to the diameters and piping classes indicated in or the request of additional terminal points, shall be submitted to IO for approval as soon as possible and before starting any manufacturing activity.

Table 10 - List of Terminal Points

Terminal Point (TP)	Nominal Diameter	Orientation	Piping Specification	Design Temp. [°C]	Design Pressure [MPaA]
Pump suction	DN150 (Pump 1) DN80 (Pump 2)	Side (Pump 1) Top (Pump 2)	4-S3S0300	100	1.2
Pump discharge (=Outlet of ARC valve)	DN150 (Pump 1) DN80 (Pump 2)	Top (Pump 1) Top (Pump 2)	4-S3S0600	100	6.0
Bypass of ARC Valve	DN150 (Pump 1) DN40 (Pump 2)	Later (Pump 1) Later (Pump 2)	4-S3S0300	100	1.2

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Terminal Point (TP)	Nominal Diameter	Orientation	Piping Specification	Design Temp. [°C]	Design Pressure [MPaA]
Drains from Pump assembly (to be collected in a single TP)	DN25 (TBC)	TBD	4-S3S0600	100	6.0
Vents from Pump assembly (to be collected in a single TP) (If manual venting or reverse circulation is not avoidable)	DN25 (TBC)	TBD	4-S3S0600	100	6.0
Cooling water inlet to auxiliary heat exchanger /jacket cooling	N/A (Non-cooling type is expected)				
Cooling water outlet to auxiliary heat exchanger /jacket cooling	N/A (Non-cooling type is expected)				
Baseplates Draining	DN25 (with a blind flange)	Side	By Contractor		

- d. All Internal piping shall be equipped with valved vents and drains to high and low points.
- e. Utilities, Vent and Drains shall be collected at battery limits. All required intersection and valves shall be included in the scope of Contractor.
- f. Isolation Valves shall be provided at each terminal point, included baseplates drains.
- g. Pump casing drain shall be connected to a common terminal point.
- h. For each flanged nozzle, the Contractor shall provide nozzle flange, counter-flange (closed with temporary end cap), bolts, nuts, washers and four gaskets (one installed and three spare). Each nozzle shall have its identification number, as specified, permanently marked on the outside cylinder.
- i. Positioning and orientation of all nozzles shall be specified on the Contractor design drawings, which will require review and written approval by IO prior to start of manufacturing. Tolerances on indicated coordinates shall be clearly stated in the related drawings.
- j. Pump Inlet and Discharge nozzle positioning shall be as per Appendix D – Installation Data and Drawings.
- k. Typical straight line at suction and/or discharge may not be guaranteed. Final configuration of piping will be clarified within KOM. Contractor shall include in his scope all features required to cope with the piping layout.
- l. In case devices such as flow straighteners would be required to guarantee proper operation of Pump and this cannot be integrated in the pump casing, Contractor shall supply the devices and spool of pipe (N2 ESPN class pipe) required to install the device. A CFD analysis shall be submitted to IO for Pump to support the chosen configuration of suction and discharge piping before testing.
- m. Nozzle reducers, if applicable, shall be included in Contractor scope.

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- n. Gaskets and hardware for all closed ports shall comply with EN 1591-1 [s24]. Dedicated analysis in line with the standard shall be issued for approval.
- o. Gasketing material shall be compatible with the intended service of Pump.
- p. All end flanges, if applicable, shall be checked for axial alignment and gasket face flatness after welding [s11].
- q. Required inlet and discharge nozzle loads relative to each load combination shall be as per values included in [Appendix B – Nozzle Loads]. The relationship between load combination and process loading conditions is given in ref [r6] and in [Appendix C – Process Loading Conditions].
- r. Contractor shall indicate in the General Arrangement the allowable nozzle loads for main nozzles and for auxiliary's nozzle for IO verification.
- s. All internal cavities of pump shall be completely self-venting, as vent piping has not been currently planned by IO. When manual venting or reverse circulation is not avoidable, Contractor shall clearly state it in the Proposal.
- t. Piping line class 4-S3S0150 (Flange rating #150) is specified for pump suction piping in [r9], however piping line class 4-S3S0300 (Flange rating #300) shall be applicable for this pump as per 7.5.5 of API 685 3rd.

9.5 Mechanical Requirements

9.5.1 Machine Casing and Pressure Boundary

- a. Pump Pressure boundary thickness shall be in accordance with API 685 3rd requirements. Sufficient allowance will be added to the wall thickness to compensate for corrosion, erosion and abrasion over the design life of Pump. The pressure casing shall be designed to operate without leakage or internal contact between rotating and stationary components while subject simultaneously to the maximum allowable working pressure, the maximum operating temperature, the worst-case combination of the allowable nozzle loads to each nozzle, in all load conditions specified in [Appendix C – Process Loading Conditions].
- b. Allowable Stress values from ASME BPVC Section VIII, Division 2 [s9] shall be applied for all equipment. Contractor shall submit to IO for approval proposal to apply other recognized standards. When applicable codes specify multiple allowable stresses for the design of pressure parts, the lower value must be used.
- c. Corrosion allowances, where needed to guarantee the design life with the requested heat duty, material choice, and water chemistry shall be included in the design.
- d. Pump MAWP shall be calculated at maximum process fluid density and will consider the most conservative condition among:
 - i. Maximum Impeller Diameter,
 - ii. 110% of Shutoff head at Rated impeller diameter,
 - iii. Deleted
 - iv. Discharge piping design pressure (5.9 MPaG (=6.0 MPaA)) and temperature (100 °C), as per [Appendix C – Process Loading Conditions], [r6] and [r16].
- e. All pressure boundaries shall be designed to withstand the design condition of the applicable piping classes (refer to [9.4.3]).
- f. Contractor shall consider in the design the cases in which equipment pressure boundary will be at lower pressure (-0.2 MPa) compared to environmental pressure (refer to Appendix C – Process Loading Conditions).
- g. In the design of the pressure casing, Contractor shall consider the requirement on hydrotest as specified in section [11.4.2].

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- h. Threaded connections on pressure casing are not allowed. Any deviation to this requirement shall be submitted to IO for approval.
- i. No repair of pressure castings (e.g. by welding) can be performed without IO approval.
- j. Pump design shall avoid unnecessary cavities where particles suspended in the process fluid can settle and/or collect (e.g., no socket welds, no spare connections). Surface finish for wetted surfaces is detailed in section 9.6.5.
- k. Pump shall be designed to allow complete draining (100% of contained liquid) and venting without any disassembly of the pump and of all other auxiliaries. Draining and venting can be accomplished through the inlet and discharge piping. If this is not possible, dedicated draining and/or venting connections shall be provided where necessary and connected to plant drain and vent system. The drain and/or vent piping shall be routed to the edge of the skids and collected to single terminal point with isolation valve.
- l. Overpressure protection for Pump is included in the system design and is out of the scope of this Specification.
- m. Pump pressure casing shall be leak tight in all loading conditions. No leakage is allowed on welded connections.
- n. Leakage rates of flanged piping connections in all loading conditions shall be limited to following values as per [d9]:
 - i. L0.01 (specific leak rate $\leq 0.01 \text{ mg s}^{-1} \text{ m}^{-1}$) for all inline connections (connections that will be exposed to piping interface loads and thermal expansion (e.g., pump suction and discharge flanges, process connections to heat exchangers),
 - ii. L0.001 (specific leak rate $\leq 0.001 \text{ mg s}^{-1} \text{ m}^{-1}$) for non-inline connections (e.g., blind flanges, heat exchanger shell side opening, filters opening).

Flanged connections shall be calculated according to EN 1591-1 [s24] to meet the required leak rate class in all loading conditions under the applicable nozzle loads.
- o. The Contractor shall provide the bolt torque and bolting sequence needed to fulfil leak rate requirement.
- p. All fasteners within the pressure boundary shall be positively locked in place with safety wire or other suitable means.

9.5.2 Pump Internals

- a. Pump rotation direction shall be selected in order to meet inlet and discharge flange layout as indicated in Appendix D – Installation Data and Drawings.
- b. Deleted
- c. Deleted
- d. Selection shall be based on a nominal impeller diameter that is not less than 110% of the minimum diameter for the given hydraulics.
- e. Selection should be based on a nominal impeller diameter that is not more than 90% of the maximum diameter for the given hydraulics.
- f. Pump rotor assembly shall be designed such that its first (dry) bending critical speed is at least 20 % above the operating speed.
- g. Contractor shall produce a lateral and torsional analysis report (dry and wet rotor, stationary and transient conditions), when required as per Table I.1 of Annex I in API 685 3rd. Even though the analysis is not needed, Contractor shall submit technical explanations and/or references to justify that the analysis is not required.
- h. Refer to section 9.7.2 for additional consideration on the influence of external magnetic field on pump performances.

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- i. Rotating parts shall be statically and dynamically balanced as per API 685 3rd requirements. A balancing procedure shall be submitted to IO for approval. A 3.1 type certificate is required for each residual unbalance check (Refer to section 11.4.3).
- j. The design of internals shall allow the extraction of the full rotor without the need to disassembly the impellers from the shaft.

9.5.3 *Bearings and Lubrication*

- a. Deleted
- b. Deleted
- c. Contractor shall demonstrate that proposed bearings configuration is fully referenced with an history of safe and reliable operation in line with the requirements of this specification.
- d. Deleted
- e. Deleted
- f. Deleted
- g. Bearing material selection shall consider qualification to process liquid and applicable environmental conditions (including radiation) as per Appendix A1 and Appendix A2. Bearing replacement interval shall be not less than 24 months.
- h. Deleted
- i. Deleted
- j. Deleted
- k. Deleted

9.5.4 *Deleted*

9.5.5 *Deleted*

9.5.6 *Deleted*

9.5.7 *Baseplate*

- a. Baseplate for Pump shall be designed and manufactured in accordance with the API 685 3rd paragraph 9.1.5.3 and as per the additional requirements of this specification.
- b. Installation constraints and available footprints defined in 9.4 and in Appendix D – Installation Data and Drawings.
- c. Baseplate shall have a drip pan to collect any water leaking out of the pump. The drip pan shall be provided with drain connection in order to drain it, if necessary.
- d. The installation configuration (footprint and building attachment locations) shall assume that the attachment points are rigid and have adequate capacity. No credit shall be taken for friction between support and foundation.
- e. Baseplate shall be designed for non-grout construction.
- f. Embedded Plates (EPs) are provided by IO in the foundations. The size and position of the EPs and orientation of Pump against EPs are shown in Appendix D – Installation Data and Drawings.
- g. Anchoring system to the foundation are included in the scope of the Contractor.
- h. Contractor shall propose to IO approval the anchoring system of the common baseplate to the EPs. Steel counter plates to be welded to EPs, intermediate frames, shim packs, bolting and levelling screws shall be included in the scope of Contractor. No removal of equipment shall be required for levelling.

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- i. Contractor shall size and produce all required analysis for the welding system at the interface between contractor's scope and EPs. Contractor shall provide interface loads on EPs for all operating and accidental scenario in order to allow IO to check the design of EPs.
- j. Guidelines of API RP 686 (as amended by this specification) shall be followed. Anchoring System shall be designed to withstand nozzle loads defined in Appendix C – Process Loading Conditions. Additionally, the structural element that are not protected by the fire insulation, shall be able to withstand the conditions indicated in section 9.6.7. IO will communicate to Contractor during detailed engineering phase the need for provision for welding of secondary structural elements to the common baseplate (e.g. additional piping supports for fire extinguishing systems, platforms for personnel access).
- k. Pump and motor supports shall be designed as rigid supports such that the vibration induced amplification on the pump and motor due to the flexibility of the supports is eliminated.
- l. Deleted
- m. Deleted
- n. Contractor shall include in the General Arrangement Drawing all tolerances related to skid anchoring.
- o. Lifting lugs shall be integrated to skids as required in 9.4.1.

9.5.8 Auto Recirculation Valve

- a. Auto recirculation valves (ARC Valves) are located on each discharge line (Valve Tag / Description : 26CVBD-VK-5714 / PL-5701 ARC Valve, 26CVBD-VK-5715 / PL-5703 ARC Valve). They are functioning for protecting back-flow of pumping liquid as check valve and automatically securing minimum flow of the pumps.
- b. Contractor shall provide ARC Valves (as option) and install directly on pump discharge flange vertically as a part of auxiliary equipment. Nozzle orientation of recirculation line will be informed by IO after Purchaser Order.
- c. Contractor shall also provide Back Pressure Valves (BP Valves), if required, at the downstream of recirculation line, assuming that the pressure of recirculation line is equal to the suction pressure of each operating case in pump data sheet. BP Valve shall be flanged type and preferably integrated into ARC valve (no separate type if possible).
- d. ARC Valves and BP Valves shall follow the requirements of both this technical specification and another technical specification of [d90]. If there is discrepancy between the two specifications, the requirements of this technical specification shall be prioritized.
- e. Contractor shall check and advise their recommendation of layout of ARC and BP Valves and piping of recirculation line, based on IO's P&ID [r9], 3D Model, Piping isometric, or/and process values provided by IO. The latest information required for this check will be provided after Purchase Order.

9.6 Materials, welding and fabrication requirements

9.6.1 Materials of construction

- a. The base material for Pump and accessories shall be austenitic stainless steel of either type 316L. Material Class A-8 of API 685 3rd applies. Other material can be proposed, subject to written approval by IO prior to Use.

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- b. All auxiliaries wetted by process fluid, cooling water fluid shall be in austenitic stainless steel. Other material can be proposed, subject to written approval by IO prior to Use.
- c. Pump pressure boundary material, including attachments to the pressure boundary and all welds, shall comply with the composition requirements for different steel product types per ASME Boiler and Pressure Vessel Code, Section II, Materials [s7] and ASME BPVC Section VIII, Division 2 [s9].
- d. All Stainless Material that is part of the scope of supply shall comply with additional composition requirements per reference [d13] included here below for reference:
 - i. Cobalt (Co) – max 0.2 wt.% for pressure retaining parts (excluding commercial parts) and wetted surface parts
 - ii. Niobium (Nb) - max 0.10 wt.%,
 - iii. Tantalum (Ta) - max 0.04 wt.%.

These requirements apply also to welding filler material.

- e. Structural elements can be supplied in Carbon Steel material. Requirement of [d13] on composition applies:
 - i. Nickel (Ni) – max 0.050 wt.%.

These requirements apply also to welding filler material.

- f. All other proposed materials shall follow requirement of [d13].
- g. Gaskets and other elastomers shall be selected to withstand all required loading condition in associations with the limits on leakages defined in 9.5.1.
- h. Selected material shall be qualified to environmental radiation levels defined in Pump Datasheet (refer to [Appendix A1] and [Appendix A2]) in combination with pressure, temperature and other environmental condition required by their installation zone.
- i. Materials of all process wetted parts, including mechanical seals and flushing systems, shall be qualified to radiation levels in the process fluid defined in Datasheet (refer to [Appendix A1] and [Appendix A2]) in combination with pressure, temperature and other environmental condition required by the installation zone.
- j. Expendable materials, defined as a non-permanent material that comes in contact with Pump and any of its materials of construction, shall not cause degradation of Pump (refer to 9.6.2). Use of expendable material shall be controlled by written procedure, which shall be approved by IO prior to use.
- k. In case of use of junctions between dissimilar materials, Contractor shall include all required provision to prevent galvanic corrosion. Earthing of the components it is not a method to prevent the galvanic corrosion.

9.6.2 Prohibited Materials and Practices

- a. Teflon and similar materials shall not be used.
- b. Halogens are forbidden in all materials of construction, including gaskets and lubricants. Deviation to this statement shall be submitted to IO for approval indicating type and quantity (burnable and not burnable).
- c. Mercury shall not be used in any manner, including during any construction of the assembly which can result in exposure of parts to the metal or its vapour.
- d. The use of nitrided surfaces exposed to the process fluid is prohibited.
- e. Care shall be taken to prevent contamination of material by red lead-graphite-mineral oil, molybdenum disulphide lubricants, halides, sulphur, copper, zinc and phosphorus.
- f. The use of materials containing asbestos or PCBs and Antimony is not acceptable.
- g. Direct contact between stainless and carbon steel/ galvanized/zinc coated steel is not permitted.
- h. Deleted

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- i. Direct contact between stainless steel and copper or aluminium is not permitted. (Except that copper chills and welding tips are permitted).
- j. Contractor shall provide his personnel with necessary requirements and guidance to prevent the introduction of any foreign material in the scope of supply, refer Working Instruction for Foreign Material [d14] and to section 9.6.2.
- k. Refer to Table 11 for applicable limit concentration of detrimental materials.

Table 11 - Limitations on Detrimental Materials

Detrimental Material	Affected Material	Maximum Concentration (PPM)	Possible Sources	Stage of Fabrication
Mercury	Nickel Base Alloys or Stainless Steel	10	Chemicals, instrumentation, mercury lighting	All
Lead	Nickel Base Alloys or Stainless Steel	10	Temperature indicating crayons, hammers, paint, temporary shielding used for maintenance, green polyethylene	All
Cadmium, Magnesium, Tin, Zinc, Antimony, Arsenic, Bismuth, Silver	Nickel Base Alloys or Stainless Steel	250	Hammers, fixtures, lubricants, cutting oils, paint, plating, wire brushes	Final cleaned surfaces or any surfaces prior to or during thermal treatment
Aluminum and Copper	Nickel Base Alloys or Stainless Steel	250	Soft pads or hammers, probes, tips (copper chill blocks & electrodes for welding are acceptable)	Final cleaned surfaces or any surfaces prior to or during thermal treatment
Sulphur	Nickel Base Alloys or Stainless Steel		Furnace atmosphere, marking materials, lubricants and cutting oils, UT couplants, fluxes, final cleaned surfaces or any surfaces prior to or during thermal treatment	Final cleaned surfaces or any surfaces prior to or during thermal treatment or machining
Chlorides	Stainless Steel	250 ppm water leachable	Human perspiration, lubricants, cutting oils, fluxes, penetrant materials, water vapor atmospheres, protective materials, lagging, UT couplants	Final cleaned surfaces or any surfaces prior to or during thermal treatment or machining
Phosphorous	Nickel Base Alloys	250	marking materials, temperature indicating crayons, lubricants, UT couplants	Final cleaned surfaces or any surfaces prior to or during thermal treatment or machining

9.6.3 Weldings

- a. All welding shall be performed in accordance with ASME BPVC Section IX [s10] or equivalent recognized standard (refer to [s1]).

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- b. The Contractor shall have all welding procedures and welders qualified in accordance with ASME Section IX Boiler and Pressure Vessel Code or equivalent recognized standard (refer to [s1]), prior to commencing any welding on the work.
- c. For equipment falling inside the extent of PED or ESPN Order, depending on the pressure category and ESPN Level, the qualification of PQR, welders and NDT controllers shall be approved by the NB/ANB in charge of the conformity assessment of the equipment. These certifications shall be either established in accordance with EN Harmonized standards or according to ASME code plus additional requirements needed to meet the requirement defined by EN Harmonized code.
- d. All Welding books, WPS, PQR shall be submitted to IO for approval.
- e. Any procedure for the repair of defects in weldments shall be submitted to IO for his approval prior to any repair being done.
- f. All pressure boundary welds shall be full penetration welds. They shall be subjected to 100% visual examination, 100% surface examination (Magnetic or Dye Penetrant Test) and 100% volumetric examination (Ultrasonic Test or Radiographies) in accordance with the applicable codes and standards as listed in this Specification.
- g. Thermal arc gouging processes are prohibited.
- h. Any heat treatments performed during fabrication or after welding shall also be duplicated on the qualification test coupon(s) and shall be included in the conformity assessment completed by the Contractor.
- i. Each weld shall be identified with a unique weld identification number on the weld control record or equivalent. Weld numbers and weld location shall be shown on the Contractor's drawings.
- j. For pressure boundary parts, drawings that show fabrication by welding shall indicate the joints, together with the joint geometry and welding process and welding procedure(s).
- k. Weld seams shall not intersect nozzle or access opening locations.
- l. Tack welds to be incorporated into the final weld shall have a contour suitable for fusion with the root pass. Tack welds that become part of the finished weld shall be performed by a qualified welder, using a qualified procedure and filler material, and visually examined. Tack welds that have cracked or are defective shall be removed, and the area re-tacked prior to welding. Tack welds in grooves shall be kept to a minimum.
- m. Temporary weld attachments to the pressure boundary shall be removed upon completion of their intended purpose. Removal shall be documented and included in the conformity assessment completed by the Contractor. If thermal cutting is used, the attachment shall be cut no closer than 8 mm from the surface to which it is attached, and the balance material shall be removed by mechanical means.
- n. Weld joint preparation shall not be performed by thermal processes. The location, depth and area size of all weld repairs, regardless of the depth of the repair, shall be documented and included in the conformity assessment completed by the Contractor.
- o. All additional requirements on welding on equipment subject to PED or ESPN directives (where applicable) shall be included in the scope.

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9.6.4 Surface preparation and Cleaning

- a. During cleaning, particular attention shall be given to the removal of weld spatter, debris and other foreign matter, particularly from the coolant passages and sealing surfaces. Final cleaning shall ensure effective cleaning without damage to the surface finish, material properties or metallurgical structure of the materials.
- b. Unless otherwise specified, or instructed by IO, equipment shall be cleaned, primed, and finish painted in accordance with the Contractor's standard specification subject to IO approval.
- c. The interior and exterior surfaces shall meet the requirements for ASME NQA-1 [s14] class B cleanliness prior to packaging.
- d. Pumps shall be free of mill scale. The inside surface shall be degreased and then flushed with clean filtered water (refer to point g of this section). It shall be visibly clean, free of sand, dirt and any other foreign matter.
- e. Welded ends should be properly cleaned and treated with a suitable rust preventive other than grease and then securely fitted with plastic or wooden caps.
- f. Grinding or lapping: Use only aluminium oxide, silicon carbide, zirconia or alumina grinding (or lapping) new wheels and in any case not previously used for on carbon or low alloy steel. Any type of grinding wheel bonded with a resin, rubber, or silicate must be submitted for review and written approval of chemical content by IO. Excessive pressure shall be avoided that may result in localized heating or smearing of the surface which can invalidate a subsequent liquid penetrant examination.
 - i. Brushing: Use only stainless steel brushes not previously used on carbon or low alloy steel surfaces. Power wire brushing shall not be performed on surfaces that require a PT examination.
 - ii. Blast cleaning: Use only new iron-free grit/sand. Steel iron grit/shot is not permitted. Glass beading or reconditioned grit/sand shall not be used unless followed by sandblasting with new grit/ sand.
 - iii. Detergent (Alkaline cleaner) wash: Hot pressure washing with a detergent may be used. Detergent shall be allowed to flow along with demineralised water for rinsing and detergent shall not get dried on the surface.
 - iv. Acid Cleaning: Pickling pastes or acid solutions, such as "Ox-out" may be used.
- g. All water used for cleaning, hydraulic testing and performance testing shall meet the requirements in [Table 12] in accordance with ASME NQA-1 [s14], Part II, Subpart 2.1, Section 304.1, Water for testing and Grade A water quality from RCC-M 2012 [s22], Annex F-III for cleaning:

Table 12 - Water Quality for Cleaning and Testing

Parameter	Requirement	
	Cleaning	Hydrotesting and Performance testing
pH at 25°C	6.0 – 8.0(1)	6.5 – 8.0
Specific conductivity at 25°C, µS/cm	< 2	-
Chloride, ppm	<0.15	50 (2)
Fluoride, ppm	<0.15	<2

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Sulfide, ppm	n/a	<1
Silica, ppm	<0.1	-
Total solids, ppm	<0.1	<500 (dissolved)
Corrosion Inhibitor (3)	-	-

(1) A drop in the minimum pH level to 5.5 is permissible on the condition that it can be shown that the drop in pH is effectively due to the carbonation of the water

(2) As per API 685 3rd, clause 8.3.2.8.

(3) When a Corrosion Inhibitor is used it shall be declared by Contractor in the Related Procedure and it shall be approved by IO.

- h. Inspection for cleanliness shall be performed for casings and internal parts prior to final closure. This in process cleanliness shall be documented on an inspection report and signed by IO.
- i. Post hydro test dryness to be ensured in different ways like blowing warm air through the unit. Further, the equipment shall be cleaned and inspected before packing.
- j. The Contractor shall submit to the IO the proposed cleaning procedure for approval/acceptance. The demonstration of meeting the above cleaning requirements represents a Hold Point (HP).

9.6.5 Surface finish

- a. Internal wetted surfaces of Pump, including welds, shall have a minimum acceptable surface finish smoother than 6.3 μm roughness (Ra). Feasibility to have a finishing smoother than 1.6 μm will be discussed with contractor during detailed engineering phase.
- b. Interior welds shall be ground flush to meet surface finish requirement.
- c. Contractor shall specify finish recommendation for Gasket sealing surfaces to be applied to the scope of supply.
- d. The external weld seams shall have a surface finish of 12.5 μm Ra or better. Surface finish shall extend a minimum distance from the edge of the weld to a distance whichever is the greater of twice the material thickness plus 100 mm or 150 mm.
- e. All burrs and rough edges shall be removed.
- f. All stainless-steel surfaces that are in contact with working fluid and with installation environment of Pump shall be passivated in accordance with the ASTM A380/A380M [s35].

9.6.6 Coating and Painting

- a. Stainless steel surfaces shall not be coated but shall be clean metal and free of weld spatter, oil, dirt, and grease.
- b. Other steel surfaces shall be coated. Selection, qualification, application and testing of coatings shall be in accordance with as a minimum to requirement given in reference [d15] (Zone II level) and in reference [d73]. Contractor can propose to IO alternative painting specifications if it can demonstrate a level of protection equivalent or higher than procedures defined above.
- c. Painting products and systems shall be free of halogens and shall be qualified for nuclear applications, taking into account the required level of radiations as per Appendix A1 and Appendix A2.
- d. Fire conditions included in section 9.6.7 apply (refer to [d73]).

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- e. Surface Preparation and Painting Specification, including painting product datasheets, shall be submitted to IO for approval.
- f. In Preliminary Colour codes, Pump and Motor shall be Blue RAL 5015. Colour shades will be confirmed in the detailed engineering phase.

9.6.7 Fire Protection and Insulation

- a. The outside of Pump and the inlet and discharge piping will be insulated as per materials given in [d16]. Insulation material will be supplied from IO to Contractor. The insulation thickness on pump casing will be of 15 mm (to be confirmed in detailed engineering phase by Contractor). Insulation thickness on auxiliary piping, when required, shall be also confirmed by Contractor in the detailed engineering phase.
- b. Type of insulation and its technical requirements are included in reference [d16]. Insulation density is 350 kg/m³.
- c. The design of the insulation material is out of the scope of this Specification. A metal temperature under the insulation shall be considered for the fire load as per case IV.T1 of [Appendix C – Process Loading Conditions].
- d. Even though insulation material itself is not part of this procurement, the design and installation of supports for installation of the insulation is included in the scope of Contractor, however, insulation supports shall be designed to withstand all loading conditions included in [Appendix C – Process Loading Conditions].
- e. Contractor shall include in this scope the Stainless Steel cladding to be installed above insulation material.
- f. The supports and skid are assumed to be not insulated and are deemed to be at a temperature of 400 °C during a fire event as per B.3 of Appendix B in [r2].
- g. Personnel Protection shall be applied to all surfaces above 70 °C.

9.7 Electrical Requirements

9.7.1 General Requirements

- a. Deleted
- b. Deleted
- c. For general information on the ITER electrical system design, see EDH Part 1: Introduction [d17]. All electrical equipment and systems within the equipment boundary shall be in compliance with the EDH Part 3: Codes and Standards and EDH [d19], Guide A: Electrical Installations for SSEN Client Systems [d51].
- d. Input for 230 VAC single-phase power circuit shall be provided for the space heater circuit.
- e. Deleted
- f. A separate terminal box shall be provided for each voltage level.
- g. Deleted
- h. All terminal boxes and enclosures shall be rated IP 66 per EDH Part 3: Codes and Standards [d19].
- i. Deleted
- j. The power cables included in the scope shall be fire and radiation resistant and halogen-free and may be chosen as per the IO Cable Catalogue [d22].
- k. The Contractor shall provide properly sized power lugs in the terminal box to accommodate the incoming line side cable.
- l. Stainless Steel cable glands shall be provided for all Junction Boxes cable entry.
- m. Deleted

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- n. Cable Terminals shall be identified and named in conformity to the project documentation.
- o. MV and LV motors and users shall follow requirement of [d17], [d18], [d19], [d20], [d51] and shall be qualified to applicable environmental radiation and magnetic field. Effect of magnetic drag shall be considered in the sizing. Minimum required service factor shall be applied on the final calculated power rating. Motor bearing shall be electrically insulated at one end to eliminate shaft circulating current that may damage the bearings.
- p. All LV electrical equipment shall follow the Low Voltage Directive 2014/35/EU and be CE marked.

9.7.2 Electric Motor Driver

- a. Pump Motor shall be rated as below. The CVBD Single-line diagram is provided for information in [d23].
 26CVBD-PL-5701 : 6600 V, 3 phase, 50 Hz
 26CVBD-PL-5703 : 400 V, 3 phase, 50 Hz
 For 26CVBD-PL-5701, it shall be rated as medium voltage, assuming that the motor rating is larger than 200kw. If it is not feasible beyond manufacturing capability and/or due to uneconomical reason, **Contractor may propose a low voltage motor pump alternatively together with a comparison table of technical and commercial points between low and medium voltage.**
- b. The motor neutral shall be isolated.
- c. Pump Motor shall be non-cooling water type (Refer to 9.1.g).
- d. Deleted
- e. Deleted
- f. Main Motor shall have a junction/terminal box(s) mounted on the motor for terminating electric power. Instrumentation connections shall be provided in separate Junction Boxes. The box shall be mounted in an easily accessible location.
- g. Main Motor shall operate successfully under running conditions at rated load with the voltage variations and frequency variations required in [d51].
- h. Deleted
- i. The motor and the motor power terminal boxes shall be of the totally enclosed type with protection class IP55 (as a minimum) in accordance with the requirements of IEC 60034-5 [s28]. The motor shall be designed to operate as required by this Specification in the normal and abnormal (including seismic event) environments, including the water mist conditions given by saturated water.
- j. The Main Motor shall have a safe stalled (locked rotor) time equal to or greater than the maximum acceleration time with the minimum starting voltage specified.
- k. Bearings shall be suitable for continuous service under the conditions specified. The type of bearing chosen shall be determined from the radial and axial thrust loads, speed of rotation, type of lubrication and load duty for which the motor is applied. Requirements given in 9.5.3 applies.
- l. Motor bearing shall be electrically insulated at one end to eliminate shaft circulating current that may damage the bearings.
- m. Pump Motor , rated 7.5kw (10 HP) or larger, shall be supplied with a space heater for the windings with the required cables wired to the local terminal box. The heater shall be rated for the power supply 230 VAC, single phase, 50 Hz. A control circuit for the heater shall be provided.

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- n. After proper preparation, all interior metal parts and external hardware of the Main Motor that are not stainless steel shall be treated with a permanent protective coating to prevent corrosion and deterioration in accordance with section 9.6.6.
- o. Deleted
- p. The Contractor shall provide the surface temperature of the Main Motor (assuming no insulation) and the heat dissipated to the environment during the design stage.
- q. The Main Motor shall have a premium quality of class F (155°C) insulation system with operating temperature by resistance at rated power, rated voltage, rated frequency and at the highest design cooling medium temperature limited to class B (130°C) in accordance with IEC 60085 [s41]. For voltage and frequency variations, paragraph 7.3 of IEC 60034-1 shall be applied and in the cases inside zone B, the temperature limits class F (155°C) shall not be exceeded.
- r. Motor windings shall be suitably treated so that the insulation is moisture resistant and adequate for exposure to incidental/accidental environmental conditions. Motor shall have fully encapsulated winding system as described in IEC 60034-1 and IEC 60072 [s29].
- s. Maximum operating and starting conditions (i.e., maximum load, minimum voltage, and maximum ambient temperature) shall be considered for the sizing and design in accordance with equipment classification and applicable standards.
- t. The Contractor shall consider the impact of the applicable magnetic field on motor performances. Also, effects of magnetic drag on pump rotor shall be considered for the calculation of required brake-power to the motor. Torque instability related to presence of magnetic field shall be assessed and any interaction of torsional natural frequency shall be verified in the train torsional analysis.
- u. The Main Motor shall have a minimum service factor of 1.15 on rated operating point. However, the motor shall be adequately sized without relying on a service factor greater than 1.0. This requirement will ensure adequate temperature profiles for the motor, adequate torque profiles for the driven load, and additional margin for overload conditions.
- v. The requirements on motor instrumentation are included in section 9.8.
- w. The Contractor shall provide the following information on the electrical motor during the bid stage:
 - i. Nominal current and starting current,
 - ii. Electric power, power factor and efficiency,
 - iii. Insulation Class (sizing and installed),
 - iv. Threshold for warning, alarm and trip on winding and bearing,
 - v. Winding temperature increase (from ambient condition) from cold start.
 The Complete list of documentation required is included in section 18.

9.7.3 Grounding/Earthing

- a. Pump and associated electrical equipment shall be grounded as per the EDH part 5: Specification for Earthing and Lightning Protection [d21] and EDH Guide A: Electrical Installations for SSEN Client Systems [d51]. Each skid shall be equipped with at least two earthing connection in opposite locations.
- b. Each terminal box shall contain respective earthing terminal.
- c. Main skids, Motor and all equipment skids shall include a minimum of two connection pads to be used for bonding and grounding.

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9.8 Instrumentation and Control requirements

- a. Due to radiation dose rate exceeding 100 Gy in silicon and to presence of neutron flux, components on the Main Skid shall not have embedded electronics (refer to [d58] and [d68]). Electronics shall be deported and installed in the safe area (inside Remote IO cabinet supplied by IO) and supplied as loose.
- b. A Distance of at least 300 m between installation area of the Main Skids and the Remote IO cabinet shall be considered. Contractor shall confirm that this distance is compatible with the selected equipment.
- c. The Plant Control System (out of Contractor scope) in interface with field instruments will manage and control all instrumentation, all electrical and electromechanical items included in this scope of supply. The configuration on interface signals between the Plant Control System and the scope of supply will be defined in detailed engineering phase after contract signature. All features required on the equipment supplied with pump to implement final control logic shall be considered as part of this scope of supply.
- d. This instrumentation shall be capable to safely work in all operating conditions defined in [Appendix C – Process Loading Conditions].
- e. All terminal boxes and enclosures shall be rated IP 66 per EDH Part 3: Codes and Standards [d19].
- f. Deleted.
- g. A minimum of one (1) Emergency Stop (E-Stop) pushbutton with a rigid stanchion shall be provided and mounted in a logical and easily accessible location on the Main Skid. E-Stops shall be of the push-pull type with a RED mushroom head and two (2) Form C contacts (Normally Open / Normally Closed). The E-Stop shall be easily removable.
- h. All instrumentation and control system shall be in compliance with I&C Design criteria document for TCWS - IBED PHTS, NBI PHTS, CVCS [d65] and with Technical Specification of PBS26 TCWS Sensors [d79].
- i. It is the responsibility of the Contractor to determine the number and location of the sensors required to protect the equipment. The process instrumentation for suction pressure, suction temperature, discharge pressure and flow rate are not part of the scope and will be provided by others. As minimum, the instruments in the following table shall be provided.

No	Code (API 685)	Instrument	Minimum required quantity
1	JE	Motor current sensor	(Out of Contractor's scope Supplied by IO in MCC)
2	PE or LE2	Leakage detector for secondary casing	1 pressure or level switch
3	TE1	Temperature sensor for Motor stator winding	1 Dual RTD per phase
4	TE2 or TE3	Temperature sensor for stator liner, containment shell or returned circulation fluid	1 Dual RTD
5	VE	Vibration sensor	1 sensor per bearing
6	N/A	Bearing wear detector	To be decided by Contractor
7	N/A	Portable rotor rotation checker	1 checker per pump

- j. For all medium voltage (MV) and low voltage (LV) motors defined in this Specification, one (1) dual-element PT100 Class A 4-wire connection resistance temperature devices (RTD), platinum rated 100 ohms at 0°C, shall be installed in the motor for each phase. Alternatively, two single element PT-100 Class A 4-wire RTDs, platinum rated 100

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Ohm's at 0°C, can be used in place of the dual-element RTDs. The protection against motor overheating will be also ensured by the detection of excessive starting time and locked rotor (Stalling time).

- k. Deleted
- l. Deleted
- m. Deleted
- n. Pump assembly (Pump and motor) shall be equipped with a minimum of one (1) temperature detector for temperature monitoring of the containment shell or stator liner or maximum liquid temperature inside the rotor chamber. Temperature detector will be either:
 - i. one (1) dual-element PT100 Class A 4-wire connection RTD, platinum rated 100 ohms at 0°C,
 - ii. two (2) single-element PT100 Class A 4-wire connection RTD, platinum rated 100 ohms at 0°C.
- o. The temperature detector mentioned in n. shall be permanently installed as close as possible to bearing surfaces.
- p. Deleted
- q. As a minimum the following vibration monitoring shall be provided:
 - i. Each bearing of Pump assembly (Pump and Motor) shall be equipped with 1 vibration detector installed.
 - ii. Deleted

Contractor can propose other configuration for vibration monitoring to IO approval.
- r. The vibration detectors shall be permanently installed, three-axis type and ground isolated with hermetically sealed cables. Sensitivity of the accelerometers shall be minimum $\pm 5\%$. Vibration Velocity readings shall be provided to IO control System.
- s. Deleted
- t. Deleted
- u. Deleted
- v. Deleted
- w. All instruments shall be wired to and clearly identified in a dedicated stainless steel instrument terminal box on the skid equipped with stainless steel cable glands. Instrument cables shall be fire resistant and halogen-free and may be chosen as per the IO Cable Catalogue [d22].
- x. All sensing lines on piping shall be equipped with isolation valves and block and bleed manifolds (2 way or 5 way manifold).
- y. All local indicators shall be installed on a gauge panel on skid limits. The location of the gauge panel shall be accessible to operator and guarantee a good reading. Final positioning will be mutually agreed between Contractor and IO during detailed design phase. These requirements apply also to auxiliary skids that are part of the scope.
- z. Temperature elements on piping shall be fitted in thermowells.
- aa. Sensor wiring shall be protected from physical damage by conduits, armoured tubing, cable trays or other approved method.
- bb. The Contractor shall provide a detailed cable list, to IO for approval.
- cc. Sub-Equipment, Instrumentation and Signal tagging shall follow ITER TTT codes list [d27] and ITER Numbering System for Components and Parts [d28].
- dd. Instrumentation and control equipment with a safety function (if any) shall follow requirements given in [d77].

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9.9 Nameplates

- a. Pump shall have a nameplate on the pump body, the motor, each auxiliary equipment, each terminal box, each cubicle. If desired, the nameplate may be multiple, provided the prescribed minimum information is included.
- b. Instrumentation and Junction boxes nameplates shall be provided by Contractor. Cable Terminals shall be identified and named in conformity to the project documentation.
- c. Each equipment, including instrumentation shall be marked with the unique identification number (tag number) agreed with IO (refer to section [9.8](#)).
- d. All nameplates shall be made of austenitic stainless-steel material and laser printed.
- e. Pumps, motor and skids nameplates shall be at least 3 mm thick and shall be permanently attached to the equipment. The nameplates and attachments shall be such that removal shall require wilful destruction of the nameplate or its attachment system. The attachment method to Pump shall not adversely affect the integrity of Pump.
- f. The nameplates shall include all information and marking as required by the design and construction codes, regulatory requirements and directives identified.
- g. Direction of rotation of the Pump and motor shall be clearly marked or stamped on the machine. A Clear correspondence of sense of rotation with the supply voltage sequence of U-V-W shall be included in the Motor Terminal Box Nameplates.
- h. In addition to the nameplate contents specified here above, the nameplate of Pump shall include the following minimum information:
 - i. Equipment name and tag number,
 - ii. PNI (refer to [13.2](#))
 - iii. Equipment model and serial number
 - iv. Rated flow and head
 - v. Fluid service/type
 - vi. Casing hydrostatic test pressure
 - vii. Maximum allowable working pressure and temperature
 - viii. Rated speed
 - ix. Lubricant type and lubrication instructions
 - x. Weight (dry and full of process fluid)
 - xi. Contractor name and address
 - xii. Manufacture date
 - xiii. CE Marking where applicable
- i. In addition to the nameplate contents specified here above, the nameplate for the motor shall include the following minimum information, unless included on Pump nameplate:
 - i. Catalogue or model number
 - ii. Equipment TAG
 - iii. PNI (refer to [13.2](#))
 - iv. Motor Contractor type and frame designation
 - v. Part number
 - vi. Power
 - vii. RPM at rated load
 - viii. Voltage
 - ix. Frequency range
 - x. Number of phases
 - xi. Temperature rise at service factor
 - xii. Insulation class
 - xiii. Time rating
 - xiv. Full load current
 - xv. Locked rotor current

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- xvi. Service factor
 - xvii. Power factor at 125%, 100%, 75%, and 50% Load
 - xviii. Total weight of motor
 - xix. Weight of rotor
 - xx. Max ambient temperature for which motor is designed
 - xxi. Contractor contact information
 - xxii. Manufacture date
 - xxiii. CE marking
 - xxiv. Lubricant type and lubrication instructions
 - xxv. Terminal arrangements
 - xxvi. Maximum permissible number of starts and the requirement cooling period when the motor is started under cold and hot motor conditions.
- j. CE marking shall be provided also on main skid nameplate to indicate that the Contractor performed all required integration activities as required by applicable directives.

10 Hazard and Risk Analysis

The Contractor shall submit hazard and risk analysis report providing the comprehensive list of Hazards and provide adequate risk mitigation measures in detailed design. Contractor shall refer to the “HIRA Risk Assessment Table” [d29] to identify the potential risks associated with the equipment. Risk analysis shall be carried out.

Contractor participation to HAZOP meetings held by IO at IO’s office and corrective actions as required by HAZOP reports shall be included in the scope.

11 Inspection and Testing

- a. The Contractor shall carry out inspection to establish and maintain quality of workmanship in his works and that of his sub-contractors to ensure the mechanical accuracy of components, compliance with drawings, identity and acceptability of all materials, parts and equipment. He shall conduct all tests required to ensure that the equipment and material furnished shall conform to the requirements of the applicable codes and of this Specification, including requirements of [Appendix A1] and [Appendix A2]. All test and test procedure proposed by the Contractor shall be notified well in advance of the fabrication and major shop test of the equipment for the purpose of making general inspections and for the progress report. The IO’s representative shall be given full access to the shop in which the equipment is being manufactured or tested and all test records shall be made available to him.
- b. Requirements for Equipment Qualification are included in section 15. All additional testing activities required for qualification shall be included in the scope of Contractor.
- c. The equipment covered under this specification shall not be dispatched unless the same has been finally inspected and tested successfully and shipping release has been issued by IO.
- d. All operations to be carried out by the Contractor shall be listed in the Manufacturing and Inspection Plan (MIP) which shall be submitted to the IO for approval. All inspection and testing shall be carried out as per MIP and test procedures, prepared and submitted by the Contractor and approved by IO.

11.1 Materials Certification

- a. All base material shall comply with the requirements of this Specification and the requirements of EN 10204 [s23] and ASME BPVC Section II, Parts A and C [s7] as

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applicable. Certified Material Test Reports (CMTRs) shall document compliance with ASME BPVC Section VIII, Division 2 [s9], ASME BPVC Section II, Part A for all pressure boundary material, including attachments to the pressure boundary and all material utilized in the production of weld test coupons.

- b. Wetted Parts and Pressure Retaining parts shall be manufactured with material traceable to EN 10204, Type 3.1 or 3.2 (when required by applicable regulation). This requirement applies also to weld filler material. For all other parts 2.2 Certificates associated with PMI can be supplied. Exception to these requirements shall be submitted to IO approval.
- c. Welding materials shall meet the requirements of the Code of Construction, as defined in API 685 3rd. CMTR shall document compliance with ASME BPVC Section VIII, Division 2, ASME BPVC Section II, Part A for all welding materials.
- d. Material Certificates shall include all additional verification on chemical composition and impurity requirement listed in section [9.6.1].

11.2 Requirements on Castings

- a. All casting materials shall conform to the relevant material specifications. All tests as called for in relevant material standards shall be carried out.
- b. Test bars shall be cast for physical tests from the same ladle of metal as the castings they represent. Four copies of the ladle analysis shall be submitted to IO. Physical tests on test bars shall be carried out in the presence of the IO's representative if required by approved MIP.
- c. The castings shall be sound, clean and free from porosity, blow holes, hard spots, cold shuts, distortion, sand inclusions and other harmful defects. Any projections in internal surfaces or on external surfaces shall be ground and smoothed for fine surface finish.

11.3 Non-Destructive Tests

- a. Components shall be subject to non-destructive tests as specified in the Data Sheets, and in accordance with API 685 3rd and other relevant Standards. All NDT procedures shall be approved by NDT level III as per ISO 9712 [s26] or SNT-TC-1A [s27] before submission to IO's approval. All NDT personnel who perform non-destructive testing shall be qualified to Level II as per ISO 9712 or SNT-TC-1A at least.
- b. For Pump, inspection class III in table 9 of API 685 3rd shall be applicable as minimum requirements. Inspection methods and acceptance criteria shall follow table 10 of API 685 3rd. Additional requirements are given in the following paragraphs. In case of conflicts, the most stringent requirement shall be applied.

11.3.1 Magnetic Test:

- a. Magnetic castings shall be examined by magnetic particle inspection as specified in the Data Sheets. The basis for acceptance shall be in accordance with Data Sheets. The requirements of ASME Section-VIII Div. 1 mandatory appendices shall be the minimum requirements.
- b. Ferromagnetic forgings shall be subject to magnetic particle testing at the areas of fillet and change of section. The testing is to be carried out after the rough machining operation (3.17 micro meters (125 micro inches)). The acceptance standard shall be as per ASME Boiler and pressure vessels code-Section VIII Div. 1 Appendix VI.

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11.3.2 Radiography:

- a. 100% radiography test shall be conducted on castings as specified in the Data Sheets. The limit of acceptability shall be defined in approved MIP.
- b. Extent of radiography on forging shall be as specified in Datasheet.
- c. The requirements of ASME Section-VIII Div.1 mandatory appendices shall be the minimum requirements.
- d. Pressure boundary of Pump shall be 100% tested.
- e. Lifting lugs and structural welds of the skids shall be 100% tested.

11.3.3 Dye Penetrant test:

- a. All non-magnetic castings shall be examined by dye penetration test as specified in the Data Sheets. The requirements of ASME Section-VIII Div. 1 mandatory appendices shall be the minimum requirements.
- b. The entire surface of the casing and impeller castings (approachable area only) shall be subjected to dye penetrant test as per ASTM Specification E-165 [s37] and ASME VIII division 1 [s9]. Non-machined surface shall be ground before dye penetrant test. For other castings only machined surfaces shall be tested by dye penetrant test.
- c. Pressure Boundary shall be re-tested after successful hydrotesting.
- d. All Welds, including structural welds shall be 100% tested.
- e. Lifting lugs and structural shall be 100% tested.
- f. For Pressure retaining welds, all the root passes and final passes of the weldments shall be examined by Dye Penetrant Test in accordance with ASTM Specification E-165 and ASME VIII division 1 [s9].
- g. Surface of the shaft shall be examined by dye penetrant tested.
- h. Dye Penetrant Test Shall be performed prior to painting application.

11.3.4 Ultrasonic Examination:

- a. Ultrasonic examination shall be performed in accordance with ASME BPVC Sec V [s8] for forgings, shafts, plates, and tubular products as specified in Data Sheet. If during the examination, ultrasonic indications are not interpretable due to, for example, grain size, the material shall be radiographed using the procedure requirements.
- b. Shafts of 50 mm dia. and above shall be ultrasonically tested.

11.3.5 Visual Inspection

- a. Equipment shall be available to IO visual inspection before shipment. Equipment shall not be painted before inspection. Where applicable, equipment shall be assembled with their spares and shown to be interchangeable. After inspection, test certificates shall be furnished.
- b. Visual inspection shall be done in accordance with ASME sec. V article 9.
- c. Acceptance criteria for castings shall be as per ASTM A802 or MSS SP-55.

11.3.6 Repair of Defects

Any defect that will not machine out during the final machining, will be gouged out fully, inspected by radiography and dye penetrant and/or magnetic particle inspection to ensure that the defect is fully removed and repaired using an approved repair procedure.

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11.4 Factory Acceptance Test:

11.4.1 General Requirements

- a. Factory acceptance test (FAT) shall be witnessed by IO. Detailed scope of witnessing will be agreed in the approved MIP and shall be considered as included in this scope of work without any cost and schedule impact.
- b. Test Procedures shall be submitted to IO for Approval at least 2 months before the scheduled inspection.
- a. Water used for cleaning, hydrotesting and performance testing shall meet the requirements given in 9.6.4.
- b. For additional testing requirement refer to Datasheet in Appendix A1 and Appendix A2.
- c. After successful completion of each of the test categories included in section 11.4, equipment shall be drained and dried and immediately preserved from corrosion. Any water that appears to have pooled or collected in Pump shall be clearly indicated on the test report and reported to IO.
- d. Purchased spare parts shall be submitted at the same level of testing required on main supply.
- e. The performance test, the mechanical running test and the complete unit test shall be performed with inlet and discharge piping spools to reproduce the geometry of the portion of plant layout significant for Pump performances (refer to 9.4.3).

11.4.2 Pump Casing Hydrostatic Tests

- a. Hydrostatic test shall be conducted for pressure containing parts at 1.5 times the design pressure and the duration of the test shall not be less than 30 minutes. Time duration will be establishing considering the leakage rate limits to be verified (refer to 9.5.1).
- b. If the part tested will operate at a temperature at which the strength of a material is below the strength of that material at the testing temperature, the hydrostatic test pressure shall be multiplied by a factor obtained by dividing the allowable working stress for the material at the testing temperature by that at the rated operating temperature.
- c. Hydrostatic Test Pressure for pump pressure boundary shall cover all loading cases included in Appendix C – Process Loading Conditions and shall be at least equal to values given in U.T1 of the same appendix.
- d. When required to verify the leakage rate given in 9.5.1 a Helium leakage test shall be performed.

11.4.3 Rotor Balancing

- a. Pump rotor assembly including impeller, shaft etc. shall be statically and dynamically balanced by the Contractor as per API 685 3rd requirements (requirements for section 6.8.6 of API 685 3rd apply).
- b. Deleted

11.4.4 Mechanical Run Test

- a. All Pump shall be run at nominal operating point for 4 hours after temperature stabilization:
 - i. Time required for temperature stabilization shall be recorded.
 - ii. Delivered flow, delivered head, bearings temperature and vibrations shall be continuously monitored and recorded.

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- b. All Pump shall be stripped off to check for wear. Parts having close clearances shall be checked for any abnormal rubbing and wear. Wearing clearances shall be measured. Strip test to be performed after mechanical run and before performance test.

11.4.5 Performance Test

- a. Performance testing shall be conducted in line with API 685 3rd, ISO9906 [s17] and as per the additional requirement listed in this specification.
- b. Hydraulic performance test shall be conducted at rated speed with water and job motor to ascertain head, power, and efficiency against capacity. Speed variation shall not exceed $\pm 3\%$ of rated speed given on the approved Datasheet and Performance curves. The Contractor shall take test data, including head, flowrate, power, bearing temperatures and vibration at a sufficient number of points, to characterize the performance curve. The list of operating points given in section 8.3.3.3.1 of API 685 3rd shall be followed. Performance curves at test speed shall be converted to those at rated speed.
- c. When Vibration is measured on non-rotating parts, requirements of ISO 10816 [s18]: apply.
- d. Deleted
- e. Deleted
- f. After acceptance by IO of test reports, a new revision of as-built performance curves and pump datasheet shall be issued.
- g. NPSH required test shall be performed on all Pump. NPSH required shall be measured in all operating points as per item b of this paragraph, except at pump shutoff. The NPSH required by the pump as measured must be lower than the NPSH available (NPSHa) in the DS over the whole pump operating range.
- h. Disassembly of multistage pumps for any head adjustment (including less than 5 % diameter change) after test shall be cause for retest, unless otherwise agreed by IO.

11.4.6 Complete Unit Test

- a. Pump complete units composed by:
 - i. Pump,
 - ii. Deleted
 - iii. Job Motor,
 - iv. Job Baseplates,
 - v. Job instrumentation,
 - vi. Deleted
 - vii. Deleted

shall be continuously run at the rated point for 8 hours with continuous recording of measurement of all instrumentation that is part of the scope of supply. All measured parameters shall be within the specified limits. Sound level test will be made according to ISO 3746 [s42] and shall be performed during complete unit tests.

- b. Deleted
- c. Additional testing, as reference test, endurance tests or repeated start/stop cycle test and other as per agreed qualification plan, shall be included in the scope when required to demonstrate reliability of pumps to the aging due to operation as per agreed qualification plan.
- d. Exceptions to this complete unit test configuration shall be submitted to IO for approval.

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11.4.7 *Testing of Auxiliaries*

- a. Auxiliaries shall be submitted to all testing required by applicable standards and by the IO applicable documentation. Full scope of testing will be agreed in the project MIP.
- b. All Auxiliaries exposed to pressure shall be hydrotested as per applicable standards. For equipment submitted to PED directive, requirement of directive will apply as a minimum.
- c. Deleted
- d. Deleted
- e. Motor Testing - Complete tests shall be performed on the motor. Tests shall be as listed on IEC 60034-2-1 and EDH Part-3: Codes & Standards. Motor Routine Test, Type Test, Insulation Test shall be applied as per applicable Standards. Complete tests shall include end play measurements and dynamic balance to verify that the motor will accelerate the load within the time specified at the minimum starting voltage. In case that Contractor cannot perform certain tests that are normally expected for conventional electrical motor due to their testing capability and their physical uniqueness of the canned motor, Contractor shall clearly state the maximum and realistic extent of the motor test in the Proposal.
- f. Deleted

11.4.8 *Final Scope of supply check before packing*

- a. Deleted
- b. Pump shall be subject to a load test of the handling/lifting lugs.
- c. A nozzle load test shall be performed at least on 1 complete skid.
- d. Final visual inspection prior to issuance of Contractor Release Note shall be completed to ensure the conformity of Pump to all specified requirements.
- e. A visual and dimensional check of full scope of supply shall be witnessed by IO.
- f. For complete set of requirements prior to shipping refer to section [13](#).
- g. Final equipment weight (dry) shall be confirmed by testing.

11.5 Site Acceptance Tests

- a. Site Acceptance Test will include a performance check after complete installation to inspect the performance of Pump including duty points, noise level and vibration. Contractor shall submit to IO for approval a procedure to be followed for site test. The procedure shall include all required acceptance criteria. This test will be performed by IO with the assistance of the Contractor.
- b. The same Vibration Levels of Factory Acceptance Test should apply to the Site Acceptance Test. Request of deviations to this clause shall be submitted from Contractor to IO for approval.

11.6 Final Acceptance

After the successful completion of Site Acceptance Tests, the equipment will be handed over to IO along with a certificate of final acceptance. The certificate of final acceptance shall be signed by both the IO and Contractor, after the definitive acceptance of each component and its related documentation. The final acceptance does not relieve the Contractor from the obligations stated in the contract.

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12 Guarantee

12.1 Performance Guarantee

- a. The equipment and accessories supplied shall be guaranteed to meet the performance requirement called for in this specification & datasheet and regulations.
- b. Guaranteed Point is the Rated Point indicated in [Appendix A1](#) and [Appendix A2](#).
- c. Performance Test Tolerances shall be as per table 11 of API 685 3rd with the following additional requirement:
 - i. Tolerance on rated head shall be -0/+3% (no negative tolerance allowed).
- d. Vibration and Temperature measured on pump shall be within limits allowed by API 685 3rd of agreed instrumentation alarm thresholds.
- e. Sound Pressure level shall be limited to 85 dBA, including test tolerances, for all locations at 1 meter from Main Skid and all auxiliary skids. For Electric Motor, requirements of IEC 60034-9 apply.
- f. Allowable pump bearing vibration values shall be in line with table 6 of API 685 3rd.
- g. Allowable pump temperature values for the containment shell, stator liner or maximum liquid temperature inside the rotor chamber shall be in line with the recommendation by Contractor.
- h. All other measured values shall be in line with applicable standards and code as well as with agreed alarms thresholds.
- i. Contractor shall demonstrate by testing that leakage rates required in section [9.5.1](#) are fulfilled.
- j. Deleted
- k. If Test Results deviate from the guaranteed values, the Contractor shall try to correct the deficiencies and if he fails, the Contractor shall replace the equipment with new one that meets the guaranteed value at no extra cost to IO.
- l. The Contractor shall guarantee for safe preservation and safe loading of equipment specified in this specification.
- m. Contractor shall clearly indicate in the project documentation all installation features required to fulfil the guaranteed performance on site.

12.2 Warrantee Period

- a. The Contractor shall provide warranty covering repair or replacement of equipment up to 3 (three) years from the final acceptance as defined in section [11.6](#). If the subject equipment or any part is found defective during the stipulated warranty period, the Contractor shall replace the same at no extra cost to the IO. Warranty period of replaced parts or items shall be further extended for two years from end of main warrantee period.
- b. The Contractor shall obtain similar warranty from each one of his Sub-Contractor. However, the overall responsibility of the warrantee shall lie with the Contractor.

13 Labelling, Cleaning, Packing, Handling, Shipment and Storage

13.1 Scope of application

The following generic requirements apply for the shipment of equipment from the manufacture site to the ITER site.

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13.2 Labelling and Traceability

- a. To be compliant with the MQP-Level-2 procedure [d30], section 5.2 and 5.1.5, before the MRR (Manufacturing Readiness Review) at Contractor level starts, the materials/items has to be catalogued in Smartplant Materials following the WI [d31] and shall be propagated to the nominated Contractor/ Contractor.
- b. Prior to MRR (Manufacturing Readiness Review), the materials/items are to be catalogued in Smartplant Materials and shall be propagated to the Contractor. The Contractor has the obligation to put ITER Ident Codes onto the materials itself.
- c. All components and the main sub-components shall be clearly marked in a permanent way and in a visible place with the IO official numbering system according to the document ITER numbering system for components and parts”, see ref [d28]. IO PNI shall be applied on all concerned items.
- d. The separate / individual components of equipment shall be marked with suitable reference numbers or symbols which shall also be indicated on the assembly drawings to aid in their identification and assembly at site.
- e. Deleted
- f. The assembly shall be shipped with identification tags as required in section [13.4].
- g. Requirements on equipment nameplates are given in section [9.9].

13.3 Spare Parts packing and availability

- a. The Contractor shall also indicate the service expectancy period for the spare parts under normal operating conditions before replacement will be necessary. All spare parts shall be despatched along with the main scope.
- b. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site, e.g. small items shall be packed in sealed transparent plastic bags with desiccator packs as necessary.
- c. Each spare shall be clearly marked or labelled on the outside of its packing with its description and purpose. When more than one spare part is packed in a single case, a general description of the contents shall be shown on the outside of such a case and the detailed list enclosed. All cases, containers and other packages shall be suitably marked and numbered for the purposes of identification. A spare parts list with identification tag nos. for each spare part shall be furnished by Contractor.
- d. All cases, containers or other packages are liable to be opened for such examination as the IO may reasonably require.
- e. Contractor shall recommend additional packing recommendations for spares purchased by IO. A pressurized Nitrogen Container shall be supplied for main capital parts wetted by process (e.g. Pump Rotor) that could be purchased.
- f. The Contractor shall guarantee the IO that before going out of production of spare parts. They shall give at least 12 months advance notice to the IO, so that the latter may order his requirement of spares in one lot, if he desires.

13.4 Packing and Handling

- a. The equipment shall be prepared for shipment so that handling and unloading may be facilitated. Equipment shall not be shipped in a disorderly arrangement or situation of disarray so as to promote damage or hamper inspection of the scope of supply when received on the job site.

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- b. The packaging shall meet the minimum requirements of ASME NQA-1, Level “B” [s14] for overseas shipping and the additional requirements stated herein.
- c. The scope of supply shall be packaged or crated to prevent deterioration, contamination, or physical damage during transit or storage. Any articles or material that may be otherwise lost shall be boxed or wired in bundles and marked for identification. The packing shall be sufficient to withstand, without limitation, rough handling during transit to their destination, as indicated in the Contract and exposure to extreme temperatures, salt and precipitation etc., during transport and open storage.
- d. Pump internals shall be preserved by means of dry nitrogen gas purge and pressurization in accordance with ASME NQA-1, Part II, Subpart 2.2, Section 304.2, Inert Gas Blankets. Proper instrumentation shall be provided for periodic checks of nitrogen conditions.
- e. The Contractor shall design and supply appropriate packaging to prevent damage during shipping, lifting and handling operations. Shock absorbing material,adequate cushioning, blocking, bracing, skidding, hoisting and tie-down provisions shall be used. The Contractor shall include specific provisions in order to check, guarantee and provide evidence that scope of supply is not exposed to extreme accelerations which could lead to unforeseen impairment of functionality. These provisions may include accelerometers or recording devices and shall be agreed with IO prior to shipment.
- f. A method of moisture control shall be provided for the interior of the shipping packages, using silica desiccant gel firmly attached to the inner surface of the cover. The desiccant shall be non-corrosive and shall not liquefy under saturated conditions.
- g. All packages shall be clearly, legibly, and durably marked with uniform block letters (preferably with waterproof paint) on at least three sides with:
 - i. Equipment name and tag number,
 - ii. IO identification and destination address,
 - iii. Purchase Order/Contract Number and Date,
 - iv. Contractor’s/Contractor's or Sub-Contractor’s/Sub-Contractor's Name,
 - v. Consignment Serial Number,
 - vi. Overall Dimensions,
 - vii. Net and gross weights,
 - viii. Sign showing 'side up',
 - ix. Sign showing 'fragile' marks in case of delicate equipment,
 - x. Sign showing slinging and sling position,
 - xi. Any handling and unpacking instructions, if considered necessary,
 - xii. Identification markings relating to the appropriate shipping documents,
 - xiii. In case of spare parts, each spare part shall be clearly marked and labelled on the outside of its packing with its description and catalogue/ part number and item number of main equipment to which it relates.
- h. Packing Procedure shall be submitted to IO for approval.
- i. Flanged nozzles shall be fitted with their counter-flange and gasket fully assembled for transportation. Main and auxiliary’s flanges/counter-flanges shall be always equipped with preservation caps/covers.
- j. Packing case size and weights shall be take into consideration, wherever appropriate, the remoteness of the ‘goods’ final destination and absence of heavy mechanized handling facilities, at all points in transit.
- k. Contractor to provide instruction for handling at site. If any assembly is required to perform at site, then method of assembly should be properly documented and accordingly all components shall be marked for identification. Guidelines for lifting and handling are provided in reference [d33].

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- l. The IO may require inspecting and approving of the performed packing before the items are dispatched. However, the Contractor shall be entirely responsible for ensuring that the packing is suitable for the mode of shipment and such inspection will not exonerate the Contractor from any loss or damage due to faulty packing.

13.5 Shipment, Transportation and Delivery

- a. The transport of the scope of supply shall be the responsibility of Contractor. The selection of the transport company shall be at the Contractor's discretion. No materials shall be dispatched without prior consent (acceptance certificate) of the IO. The scope of supply must be transported up to the place of installation or storage only by an experienced and qualified carrier.
- b. In order to proceed with shipment, the Contractor shall present Contractor Release Note (CRN) in accordance with ref [d42]. The CRN represents a Hold Point.
- c. Each shipment shall be accompanied by a Delivery Report (as per template [d36]) prepared by the Contractor, that shall be signed by a representative of the IO. The signature by the IO of the Delivery Report prior to shipment represents a Hold Point (HP).
- d. A Package & Packing List Template, see ref [d35] and the equipment storage and preservation requirements form Template - Equipment Storage & Preservation Requirements Form (see ref [d37]) shall be submitted to IO Logistic team at least 15 working days prior to the planned shipment date.
- e. For export, Regulation in force in the country of destination shall be applied, in particular with respect to the type of packaging authorized.
- f. Upon receipt of the package, the IO shall open the package and make a visual inspection of its content.
- g. In the case of anomalies, the IO will make any additional relevant remark on the inspection.
- h. A final decision on acceptance of the delivery of the components will be made by the IO. If the components are in an acceptable condition, the IO will sign the Delivery Report. The signature of the Delivery Report is an IO Hold Point. The original of the Delivery Report shall be kept by the IO and a copy of it shall be kept by the Contractor.

13.6 Preservation after shipment

Contractor shall clearly indicate the activities that must be performed for preservation during the equipment storage (long and short term). The packing shall be designed to allow all required interventions without compromising the required storage time. The Contractor shall also indicate the required preservation activities after equipment installation in its final location in the plant.

14 Quality Assurance

The Quality class under this contract is QC-1. GM3S [d1] section 8 applies in line with the defined Quality Class.

- a. Quality Requirements shall be in accordance with the "Quality Requirements for IO Performers" [d42] and with Quality Classification Determination [d3]. The ITER Quality Assurance Program shall be applied to all the work under this Contract. The ITER QA Program is based on IAEA Safety Standard GS-R-2 and on conventional QA principles and integrates the requirements of the "INB Order dated 7 February 2012" [d46] on the quality of design, construction and operation in Basic Nuclear Installation. For this purpose, the Contractor and Sub-Contractors shall be in compliance with the

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- requirements given by the relevant ITER QA classification and shall have an IO an ISO 9001 accredited quality system, in compliance with the above mentioned requirements.
- b. All requirements of this Technical Specification and subsequent changes proposed by the Contractor during the course of execution of this Contract shall be in line with deviation request and non-conformity management procedures described in see ref [d47] and [d48].
 - c. Documentation developed as the result of this Contract shall be retained by the Contractor for a minimum of 5 years and then may be discarded with the approval of IO. The use of computer software to perform a safety basis task activity such as analysis and/or modelling, etc. shall be reviewed and approved by the IO prior to its use, in accordance with *Quality Assurance for ITER Safety Codes Procedure*, see ref [d43].
 - d. Prior to commencement of any work under this contract, a “Quality Plan” (QP), describing how the ITER procurement quality requirements will be implemented (see ref [d42]), shall be produced by the Contractor, sub-Contractors and sub-Suppliers, The QP shall be submitted to the IO for approval,

14.1 Responsibilities

- a. Sub-Contracting shall be managed in line with requirement of section 6.4 of [d1]. The Acceptance form required in 6.4.1 of [d1] can be replaced by the list of Sub-Contractors and Sub-Suppliers to be submitted to IO for approval.
- b. The Contractor shall be fully responsible for quality with respect to all services, materials, manufacturing, testing, etc.
- c. Contractor shall be responsible for imposing all contractual technical and quality requirements, as applicable, to all sub-Contractors and sub-Suppliers furnishing hardware or services.
- d. QA and QC activities by IO shall not relieve the Contractor and their sub-Contractors from responsibility to perform all inspections and tests required by the contract and governing codes and standards.
- e. The services required to Third Parties (Notified Body or Agreed Notified Body), as required by the applicable laws and standards shall be included in the scope of Contractor.
- f. Any deviation to the specification requirements or IO applicable documents shall be submitted to the IO for review and acceptance, in writing, prior to proceeding.

14.2 Testing Equipment Calibration

- a. All the instruments used for the specified shop tests shall be calibrated and calibration certificates shall be furnished from laboratories accredited for the applicable standards. The laboratory shall be certified in accordance with ISO 17025 [s43]. The calibration shall have been carried out not more than six months prior to the testing date. Certificates of Calibration must be submitted to IO.
- b. Pressures gauges shall be calibrated before and also after tests.
- c. All measurements used in testing shall have an evaluation of the total measurement uncertainty following ASME PTC-19.1. An equivalent standard can be used subject to prior acceptance in writing by IO. The calculation of the measurement uncertainty shall be documented in a report and added to the final test report. Requirements on testing accuracy given by API 685 3rd apply.

14.3 Manufacturing and Inspection Plan (MIP)

- a. Prior to commencement of any manufacturing, a *Manufacturing and Inspection Plan* (MIP) shall be produced by the Contractor and Sub-Contractors and approved by the IO,

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who will mark up any intended intervention point. MIPs are used to monitor Quality Control and acceptance tests during the execution of the Contract. It shall meet the requirements of given in reference [d42]. It should be noted that interventions additional to those required in this Technical Specification may be included on the MIP by the IO. Control Points are defined in section 8.4 of [d1].

- b. In case of witness point, Contractor shall notify IO at least 2 weeks to the selected test step.
- c. The MIP shall explicitly identify PIAs. Contractor may refer to a non-exhaustive list of PIAs for the design, manufacture and transportation of the components as provided in reference [d53] and ITER-defined list of PIAs given in reference [d50].
- d. The right of the IO listed above shall apply in relation to any sub-Contractor and in this case the IO will operate through the Contractor. The overseeing of the quality control operation by the IO shall not release the Contractor from his responsibility in meeting any aspect of this Technical Specification.
- e. The IO approved MIP is a prerequisite to the Contractor proceeding with the work contained. It is permissible for the IO to indicate partial approval to authorize operations that would be constrained due to issues with subsequent operations.

15 Qualification requirements

- a. The primary objective of qualification is to demonstrate with reasonable assurance that, the design of an equipment, for which a qualified life or condition has been established, will perform its function without experiencing failures before, during and after applicable events.
- b. Equipment required to ensure primary fluid containment function shall demonstrate their capability to properly perform this function in all loading conditions defined in Appendix C – Process Loading Conditions.
- c. The Guidelines given in reference [d10] apply to the scope of this specification.
- d. One of the qualification schemas for mechanical components from ASME QME-1 [s44] or RCC-M [s22] shall be applied (vol Q of RCC-M can be applied for active mechanical equipment).
- e. Basic Requirement for electrical and instrumentation components if a qualification as per RCC-E K2 level [s21]. Deviations to this requirement shall be submitted to IO for approval. This is required to demonstrate the capability of the equipment to withstand the environmental condition (e.g. radiations and static magnetic field) required during category I and II conditions. Furthermore, instrumentation and electrical devices (if any) required to ensure primary fluid containment function shall demonstrate their capability to properly perform this function also in category III and IV events..
- f. The scope of supply shall be qualified to the following main conditions:
 - i. Reference Tests
 - ii. Electromagnetic compatibility
 - iii. Magnetic field
 - iv. Equipment Aging (thermal / cycling)
 - v. Irradiation
 - vi. Seismic
 - vii. Fire

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- g. Additional qualification activities, as required in [d10] shall be added in the qualification plan when required to demonstrate the ability of the pump unit to perform its safety functions.
- h. Qualification requirements are further discussed in the below sections:
The Contractor shall follow requirements give in [d56]. It also has at disposal IO guidelines provided given ref [d54], [d74], [d75], [d82], [d83], [d84].
- i. When COTs Items are supplied as part of the scope, supplier shall integrate all required data to demonstrate capability to withstand applicable loading conditions. Methodology is given in [d80] and [d81].

15.1 Qualification Strategy and Approach

- a. Qualification method by analysis or by testing shall be selected by Contractor considering the required qualification parameters and the applicable standards and codes.
- b. When using analysis, contractor shall apply procedures
- c. The Contractor shall select software tools qualified and approved by IO as indicated in reference document Software Qualification Policy, see ref [d55]. Requirement on Models storage are given in [d86].
- d. Contractor shall implement procedure for analysis and calculations in compliance with references [d85], [d70], [d71], [d86], [d87].
- e. The Contractor shall prepare and execute corresponding Qualification Strategy or Methodology to fulfil the qualification requirement of the supplied equipment.
- f. For Seismic Qualification, when functionality is required also after the seismic or accidental condition (=SC-1(SF), refer to note d. of Table 8), qualification should be through be both analytical evaluations and shake table test. Eventual request of exemption from shake table test shall be fully demonstrated by Contractor and approved by IO.

15.2 Qualification Plan

- a. Qualification Plan shall be submitted to the IO, for review and acceptance, before any qualification activity is undertaken.
- b. The Qualification Plan shall follow guidelines given in reference [d54].
- c. The qualification plan shall include provisions for test inspections at pre-determined points of the test sequence.
- d. Any of the qualification reports prepared as part of this program shall be available for review by the IO and shall be included in the final report. The final report shall be prepared and submitted to the IO for review and acceptance.

15.2.1 Inspection Plan for Qualification Tests

- a. The qualification testing Inspection Plan shall be provided by the Contractor and agreed with IO prior to the start of the qualification plan. The proposal shall include Hold Points and/ or witness points.
- b. In case of witness point, Contractor shall notify IO at least 2 weeks to the selected test step.
- c. These procedures, coupled with the qualification plan, shall form a complete picture of the program to be conducted and activities to be performed.

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15.3 Seismic Qualification

- a. The SL-1 earthquake is considered a category II event (refer to [Appendix C – Process Loading Conditions](#)). Contractor shall demonstrate that Pump are able to withstand this type of event with no impact on their structural integrity and functionality.
- b. Pump are classified SC-1 (S). They shall be qualified to guarantee integrity and process fluid confinement during an SL-2 seismic event. The floor response spectra related to SL-2 are provided in [Appendix E – Seismic Loads](#). The complete methodology of active component for seismic qualification can be obtained from ASME QME-1 [\[s44\]](#) non-Mandatory Appendix QR-A, and the requirements shall follow prescription given in [\[d56\]](#).
- c. Contractor shall demonstrate that, after a SL-2 Earthquake, no rupture of piping, no collapse of structures or equipment, limited plastic strain, limited concrete cracking, structural support functions maintained, and process fluid leakages remain within the levels required in this specification. With these requirements, it is possible that a small level of deformation could occur. Additionally, it is required that Pump will not suffer any shaft seizure during and after the SL-2 event.
- d. Deleted
- e. When demonstration by analysis is selected, requirements given in [\[d70\]](#) and [\[d71\]](#) apply.
- f. A typical test sequence is described below, to be applied when demonstration cannot be performed only by analysis. It is strongly recommended to record the below steps through photographs or video.
 - i. Pre- Test: The test shall be performed to identify the following parameters:
 - Material and Assembly condition,
 - Operability Status (Verify the operability before testing, if required),
 - Leak tightness and Mounting,
 - Location, attachment, orientation and operability of seismic test instruments like accelerometers,
 - Verification of shake table input parameters and assure that instrumentation is properly calibrated.
 - ii. Test: Shake table testing, with or without functionality checks during tests, as specified by Contractor in the test specification.
 - iii. Post Test: Repeat the pre-test checks and confirm the operability as specified by designer in the test specification.
- g. The qualification procedures shall be submitted to the IO, for review and acceptance, before any qualification activities is undertaken.
- h. Acceptance Criteria shall be provided by Contractor and approved by IO.

15.4 Static Magnetic Field

- a. Static Magnetic field to which components are exposed is included in [Appendix A1](#) and [Appendix A2](#). The equipment qualification shall address the exposure of the equipment to this environmental condition.
- b. For the qualification to static magnetic field, testing has to be performed with a field strength that is 1.4 times the current field values and as per the magnetic field compatibility tests specified in “Test Method for ITER Equipment for Static (D.C) Magnetic Fields” Chapter 5 [\[d57\]](#).

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15.5 Electro-Magnetic Compatibility

- a. Qualification should ensure that the electromagnetic emissions from equipment stay within acceptable limits through the qualified life and during incidental or accidental events, otherwise they may affect the other equipment. This qualification ensures also the immunity of the supplied equipment to external electromagnetic fields that can present in the installation environment.
- b. Electromagnetic compatibility shall follow the EMC 2014/30/EU and EDH Part 4 [d20]:
- c. Electromagnetic Compatibility Testing shall be performed as required by applicable standards mentioned in [d20] and as per additional requirements of IEC 61000 - 2019.

15.6 Irradiation

- a. In regard to this chapter, it should be noted that TCWS equipment is submitted to “irradiation” during “Normal Operating Condition” (Category I event).
- b. Contractor shall demonstrate the compatibility of the supplied equipment to work when exposed to the expected radiation dose in the installation Area. For Pump expected doses in the environment and in the process fluid are given in [Appendix A1] and [Appendix A2].
- c. For Electrical, Electro-mechanical and Electronic components, additional guidelines give in reference [d58] apply.
- d. References for effects of irradiation by neutrons is given in [d11] and [r12] as amended by [d68].
- e. Process Piping is classified N2 as per ESPN codification (refer to [d12]), while ARC valve is classified as N3. Supplier can submit a request of exclusion of pump pressure casing and ARC valve (& BP valve), from PED directive and consequently from ESPN (refer to section [8]). However, PED is applicable to auxiliaries. For auxiliary equipment connected to pump pressure casing supplier shall refer to the French ESPN decree to determine its applicability and the related classification.

15.7 Aging

- a. Effect of Aging during equipment life shall always be taken into account, considering that the equipment shall be capable to guarantee the required safety function during all its operating life. When qualification by analysis is proposed by Contractor, it shall be supported with experimental data available on similar equipment. Extrapolation of existing data shall be limited and shall be submitted to IO approval. When existing data cannot satisfy the qualification requirement, testing shall be performed.
- b. Effects of vibrations and cycling have to be considered (refer to [d10]). Vibrations can affect the life of the equipment as well as their normal performances. Dedicate qualification activities shall be performed to consider both these conditions.
- c. The Contractor shall integrate in his maintenance plan all preventive activity required for the replacement of wear parts and other equipment exposed to aging. An interval of 24 Months for preventive maintenance shall be considered.
- d. The accidental tests shall be performed on the same specimens used for ageing tests. The accidental conditions need to be simulated at the end of the qualified life.

15.8 Fire

- a. Contractor shall demonstrate the capability of the equipment to guarantee the integrity and containment function during and after a fire event (refer to [r15]).
- b. The applicable loading condition related to a fire event are included in section [9.6.7] and in [Appendix C – Process Loading Conditions].

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15.9 Electrical Conditions

Contractor shall demonstrate capability of supplied equipment to operate successfully under running conditions at rated load with the voltage variations and frequency variations required by EDH Guide A: Electrical Installations for SSEN Client Systems [d51] and in reference [d10].

15.10 Qualification Reports

- a. Qualification report shall be prepared by the Contractor. The report shall provide the level of information required in [d54] and [d72].
- b. Any of the qualification reports prepared as part of this program shall be available for review by the IO and shall be included in the final test report. A final report shall be prepared and submitted to the IO, for review and acceptance that provides evidence of the qualification of the subject equipment and shall cite any precautions, restrictions, or limitations which must be accounted for by the IO in order to maintain the qualified status of the subject equipment (refer to [15.11]).
- c. When applicable, a separate complete report for shake table test shall be prepared after completion of the shake table test.

15.11 Preservation of Equipment Qualification

- a. Qualification Preservation Sheet shall also be completed at the end of the qualification process to provide to the operator, as well as to the other Contractors and installers/assemblers, the requirements to ensure that the qualification is preserved over time during installation, assembly and operation phases.
- b. Maintenance strategy shall be conceived in order to guarantee the preservation of the qualification.
- c. Reference files as defined in RCC-E [s21] should be provided at the end of the qualification process. Alternative methods of identification and storage of technical and qualification features of the supplied equipment can be proposed by Contractor to IO for approval.

16 Safety requirements

- a. Safety Classification of the equipment in this scope of supply is defined in section 8.
- b. Pump Units shall fulfil design requirement of SIC /PIC classified equipment, in line with the INB order [d46] considering that:
 - i. The order 7th February 2012 applies to all the components important for the protection (PIC) and all the activities important for the protection (PIA),
 - ii. The compliance with INB order must be demonstrated in the chain of external Contractors,
 - iii. In application of article II 2.5.4 of the order 7th February 2012, contracted activities for supervision purposes are also subject to supervision done by the nuclear operator.
- c. The scope under this contract covers for PIC and PIA. GM3S [d1] section 5.3 applies.

16.1 Propagation of Safety Requirements

- a. ITER is a nuclear facility (an “INB”, for Installation nucléaire de base, “Basic nuclear installation” in French regulation) identified in France by the number “INB no.174” [d46].

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- b. The Contractor must comply with all requirements expressed in see ref [d45]. For each requirement, the external intervener must explain in its quality system the dispositions taken to implement the requirements stipulated in [d45].
- c. Safety Important Class (SIC) describes a classification scheme for structures, systems and components (SSC) of ITER that perform a safety function and contribute towards meeting the General Safety Objectives at ITER during incident/accident situations. Components classified SIC are divided into:
 - i. SIC-1 are those required to bring to and to maintain ITER in a safe state,
 - ii. SIC-2 are those used to prevent, detect or mitigate incidents or accidents, but not SIC-1
- d. PICs require control and guaranty, during the design, manufacturing and transportation phase, to ensure its safety functions can be maintained in all postulated situations. This is accomplished through the guidelines provided for in the Management of Propagation of Nuclear Safety Requirements in the Contractor Chain, see reference [d49].
- e. In every contract involving PIA and PIC, it must be clearly stated that defined requirements on PIC and PIA have to be fulfilled. For PIC and their defined requirement, the procedure [d49] applies. For PIA and their defined requirement reference [d50] applies. The classification corresponding to the graduated approach of PIC is specified in document in see ref [d59].
- f. In the contracts passed down to the sub-Contractors, in addition to technical requirements and defined requirements on PIC, IO shall ensure the surveillance of the Protection Important Activities (PIA). The Contractor shall ensure the technical control. The sub-Contractor must possess a quality system in agreement with the importance of the products being delivered and for the follow-up of the PIA corresponding to the PIC to be provided under the contract. The Contractor shall provide documented information on how to perform the technical control (each protection-important activity undergoes technical monitoring), to ensure that the activity is carried out in compliance with the requirements defined for the activity and, if necessary, for the protection-important components concerned and that the appropriate corrective and preventive actions have been defined and implemented. This system shall be included in the MIP or Quality Plan.

17 Specific General Management requirements

- a. Requirement of GM3S [d1] section 6 applies completed/amended with the below specific requirements.
- b. The Contractor shall designate a Project Manager, who will be responsible for the overall design, documentation, qualification, manufacturing, inspection, testing, packing, safe delivery to site, schedule, cost control and resolution of disputes and discrepancies. The Contractor shall also identify specific individuals responsible for each aspect of the Work.
- c. The Contractor shall provide a schedule identifying the submittals to and approvals from IO of the Contractor's and Sub Contractors' specifications, drawings, analysis reports, procedures, and other types of documents as appropriate.
- d. As a minimum the schedule shall include task descriptions with start and finish dates for each task. Separate detailed task breakdowns shall be provided for design, documentation, procurement, manufacturing, testing phases and end with a Scheduled Site Delivery Date.
- e. The schedule shall be in a Critical Path Method style with logic ties that identify each activity and is capable of tracking percentage complete for verification of progress. The schedule is subject to IO's approval.

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- f. The schedule shall include all work activities identified within the Specification. The schedule shall include milestones for design, documentation, manufacturing, inspection, shop testing and delivery to allow for IO to monitor the progress of the work and to schedule its interface activities with the Contractor. The schedule shall include all documents and deliverables listed in the Specification as minimum.
- g. The Contractor shall participate in a Project Kick-off Meeting and subsequent status meetings as agreed and requested by IO.

17.1 Responsibilities

The responsibilities between the IO and Contractor are defined in the below **Table 13** and is further detailed in the following sections.

Table 13 - Summary of Responsibilities between the IO and the Contractor

Activity	IO	Contractor
Phase 1 Design & Documents	A	R
Phase 2 Qualification		
Qualification Plan	A	R
Qualification Tests	A	R
Phase 3 Manufacture, Assembly, FAT and Delivery		
Manufacturing Readiness Review	A	R
Manufacturing	A	R
Inspection	A	R
Factory acceptance Testing	A	R
Delivery Readiness Review Packing, Shipping and Safe Delivery to the ITER site	A	R
Phase 4 Site Acceptance Test (SAT)	R	A

R = Responsible for organizing, performing and for the content

A = Review/Comment/Accept

17.2 Contract Gates

- a. Main Contract Gates are (refer to **[d1]**):
 - T0: Contract Signature
 - T1 : Kick-off Meeting (at IO's office)
 - T2 : IO approval Of the Delivery Schedule, Quality Plan And Procurement Strategy,
 - T3: Manufacturing Readiness Review /Start of manufacturing (at Supplier's office)
 - T4: FAT Readiness Review/Start of Testing (at IO's office)
 - T5: Delivery Readiness Review (refer to **[d69]**)
 - T6: Delivery to ITER Site
 - T7: Closing of all agreed Project Documentation
 - T8: Final acceptance after SAT and contract Close-Out

The Gates shall be represented in the contract schedule submitted by Contractor.

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- b. Forecasted Schedule of Contract Gates together with the List of Deliverable associated to each gate are included in section 18.

17.3 Data Management

- a. The data generated during the execution of the contract shall be handled electronically and entered into the ITER database (refer to section 6.2 of [d1]). Contractor shall use this database to store information related to the contract. All data entered in the database will be kept strictly confidential by the IO and, under no circumstances, will be communicated or made accessible to other Contractors or the DAs (Domestic Agency).
- b. Data consistency checks shall be implemented to facilitate IO oversight. Relevant data shall be made available by the Contractor to the IO through ITER database each time a control point is requested, or a deviation request, a non-conformance report or any other document which is part of the contract deliverables is issued by the Contractor, in accordance with the document “IO / In-Cash Contractor Documentation Exchange and Storage Working Instruction”, see ref. [d41]. The requirement does not apply for other documents through specialised CAD software (e.g. CATIA, see System design and others) and so undergo other requirements in separate documents.
- c. The reference scheme is for the Contractor to work in a fully synchronous manner on the ITER CAD platform, as per detailed in 6.2.2.2 of [d1]. This implies the usage of the CAD software versions and the connection to one of the ITER project CAD databases. Considering the scope of work is a detailed design and manufacturing of complex equipment, it's unlikely that the ITER CAD official authoring tools will be used and a multi-CAD approach is considered. In such cases, the Contractor shall provide the drawings through SMDD (PDF format together with a neutral format such as .dwg). The corresponding 3D model shall also be provided, including both a STEP file (.stp) and the native CAD file. IO will then update the CMM and DM accordingly. The applicable CAD requirements will be defined in a Design Collaboration Implementation Form (DCIF), which will be prepared by IO and issued to the Contractor separately. Any cost or labour resulting from a deviation or non-conformance of the Contractor with regards to the CAD collaboration requirements shall be incurred by the contractor.
- d. In addition to 6.2.2.1.3 of [d1], when contractor receives IO's comments in a CRS (comment resolution sheet) format, prepared by IO, on their submitted documents, contractor shall re-submit their revised documents within 14 calendar days together with the CRS fully answered & filled by Contractor. Any change in the revised documents shall be clearly highlighted by triangles or cloud marks with a version number.
- e. Any Documents and drawings that are submitted to IO shall be searchable in PDF for easy check by IO. Bookmarks in PDF shall be properly established especially for documents with multiple pages.

17.4 Reviews

- a. The Contractor shall organise Design review, Status reviews, Quality control reviews and Manufacturing Readiness Reviews. These may be focussed on particular areas of production. The IO may also decide to organise reviews, in which case the IO will appoint the review group and define its terms of reference.
- b. Contractor shall submit at least the below list of approved documents for Manufacturing Readiness review (other document can be required as per section [18]). MRR shall be conducted as per [d60]:
 - i. General Arrangement of the Supplied Equipment and Auxiliaries,
 - ii. Performance curve and Datasheet,

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- iii. P&ID of the Scope of Supply,
 - iv. Mechanical design calculation,
 - v. Qualification plan,
 - vi. Quality plan,
 - vii. Manufacturing and Inspection Plans,
 - viii. All test procedures,
 - ix. Procedure for Surface preparation and painting,
 - x. Packing and Shipping procedure and details.
- The IO may decide to put a hold point on them.
- c. Safety Reviews will be organised at each stage of production, as required by the IO.

17.5 Monitoring and Access Rights

- a. Refer to section 6.1 of [d1] for required contract monitoring.
- b. IO reserves the right to perform unscheduled inspection in accordance with para 3.10 of the “Quality Requirements for IO Performers”, see ref [d42]. Planned and documented audits will be performed by the IO, and regulators body representatives in France, to verify compliance with the technical and quality requirements of the contract. Moreover, the IO reserves the right to take photographs of the ITER equipment during the contract life.

18 Project and Deliverables Schedule

- a. The Contractor shall provide IO with the documents and data required in the application of this technical specification, the GM3S Ref [d1] and any other requirement derived from the application of the contract.
- b. Documentation is intended to be individual for each equipment. When information is identical for different equipment, documentation can be issued as a common document. IO reserves the right to ask for dedicated documentation for each train when required for project needs.
- c. Test Certificates, End of Manufacturing Report, as built drawings shall be individually submitted for each Pump with no exception.
- d. Contractor shall prepare a document schedule based on the above and using the template available in the GM3S Ref [d1] appendix II.
- e. Contractor shall include IO document code, when available, in all submitted documents and shall mention the relative IO code when a project deliverable is referenced in any other document.
- f. Any additional document required by the scope of work defined in this specification shall be considered as part of the contract and shall be provided by Contractor.
- g. When requested by IO, Native format of documents listed in Table 14 shall be supplied by Contractor.
- h. Forecasted dates of Project Gates are presented in Table 14 together with a minimum list of documents, required within the expected timing.
- i. Deleted
- j. List of key Document, related to contractual milestones will be agreed and finalized before contract award.

Table 14 - List of Deliverables with Contract Gates

D#	Deliverable Details	Type and Quantity	Due Date	A	B	C	D	E
Documentation Required during the Bid Stage								

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D#	Deliverable Details	Type and Quantity	Due Date	A	B	C	D	E
a.	Project Schedule	1E	with the Bid					
b.	Datasheets of Main Equipment (Fully filled in Appendix A1 & Appendix A2)	1E	with the Bid					
c.	Datasheet or selection sheet of auxiliaries (heat exchangers, Electric Motors, ARC valve (& BP valve), etc.)	1E	with the Bid					
d.	Performance Curves (pump head at min/rated/max impeller diameter, efficiency, power consumption, NPSH), including curves for parallel operation	1E	with the Bid					
e.	General Arrangement drawing of main skid, Auxiliaries skids and/or loose supply items (if any), including foundation details, static weights(dry/wet) and dynamic weights	1E	with the Bid					
f.	Pump Cross Sectional Drawing	1E	with the Bid					
g.	P&ID of the scope of supply, including all auxiliary piping	1E	with the Bid					
h.	Sub-Contractor & supplier List, including countries of execution offices and manufacturing factories.	1E	with the Bid					
i.	Instrument List and Datasheets with compatibility of Static Magnetic Field, Electro-Magnetic & Irradiation	1E	with the Bid					
j.	Electrical and Instrumentation wiring Diagram	1E	with the Bid					
k.	List of clarification & deviation from Applicable Documents & Codes and standards (if any)	1E	with the Bid					
l.	Quality Plan	1E	with the Bid					
m.	Qualification plan including seismic analysis	1E	with the Bid					
n.	Manufacturing and Inspection Plan (MIP)	1E	with the Bid					
o.	List of References 1) For pumps with similar duty and qualification level in nuclear fission/fusion plants 2) For pumps with similar duty and/or qualification level in other plants than nuclear	1E	with the Bid					
p.	Catalogues of Contractor/supplier and selected pump	1E	with the Bid					
q.	Maintenance schedule (in line with requirement of 9.2)	1E	with the Bid					
T0 – Contract signature								
T1 – KoM			Within 2 weeks from T0					
1.	MoM of the Kick-off meeting	1E	T1		X			
2.	List of Deliverables (in the format of Appendix II of GM3S [d1])	1E	T1 + 2 weeks		X			
3.	Final version of delivery schedule	1E	T1 + 2 weeks		X			
4.	Quality Plan (Final)	1E	T1 + 4 weeks		X			
5.	Contractor Catalogues (if applicable)	1E	T1		X			
6.	Sub-Contractor and sub-supplier List, Sub-contractor acceptance forms and Procurement Strategy	1E	T1 + 8 weeks		X			
7.	Procurement Design Verification and Validation Plan	1E	T1+12 weeks		X			
T2 – IO approval of the Delivery Schedule, Quality Plan and Procurement Strategy			T1 + 8 weeks					
8.	Complete P&ID for Pump Unit	1E	T2+2 weeks	X				
9.	Cause and Effect Diagram	1E	T2+12 weeks	X				
10.	Pressure Temperature Profile in the Recirculation Circuit	1E	T2+8 weeks	X				
11.	Bills of Material for all material included in the scope of supply: Main Skid, Auxiliary equipment	1E	4 weeks prior to manufacturing		X			
12.	Datasheets of Supplied Equipment: Pump, Motor, ARC valve (& BP valve), etc (ITER Format, when available, or format given by applicable standards)	1E	T2+2 weeks	X				
13.	Pump Performance Curve (pump head at min/rated/max impeller diameter, efficiency, power consumption, NPSH)	1E	T2+2 weeks	X				
14.	Interface Document including electrical loads list and utilities list	1E	T2+6 weeks	X				
15.	General Arrangement Drawing of Pump Skid with auxiliaries, including baseplate & foundation details, anchor bolts details, counter-flange details with gaskets and bolts & nuts, static(dry/wet) and dynamic weights, allowable nozzle loads, template details (for fixing anchor bolt locations), ARC valve (& BP valve), together with 3D Model Step File (Refer to 9.4.1)	1E	T2+4 weeks	X				

SUPPLY

D#	Deliverable Details	Type and Quantity	Due Date	A	B	C	D	E
16.	Recommended Layout for ARC valve and recirculation piping	1E	T2+8 weeks	X				
17.	Deleted	1E	4 weeks prior to manufacturing	X				
18.	Cross Sectional Drawing of Pump, Motor and auxiliaries	1E	4 weeks prior to manufacturing	X				
19.	Deleted	1E	T2+4 weeks	X				
20.	Deleted	1E	4 weeks prior to manufacturing	X				
21.	Deleted	1E	4 weeks prior to manufacturing	X				
22.	Motor Datasheet and GA Drawing (including terminal boxes details)	1E	T2+8 weeks	X				
23.	Auxiliary Heat Exchangers Calculation (if any)	1E	T2+8 weeks	X				
24.	Detailed Drawings of sub-components (baseplate, valves, LV pumps and motors, piping isometrics, special tools, lifting tools, ARC valve (& BP valve), etc.)	1E	T2+8 weeks	X				
25.	Motor Characteristic Curve i. Speed -Torque curve at rated & minimum starting voltage. ii. Current Vs Speed Curve. iii. Current Vs Time Curve iv. Thermal withstand characteristic for Motors - Hot and Cold.	1E	T2+8 weeks	X				
26.	All other Electric Motor Drawing	1E	T2+8 weeks	X				
27.	Deleted	1E	T2+8 weeks	X				
28.	Deleted	1E	T2+8 weeks	X				
29.	Instrumentation Hook-up drawings	1E	T2+8 weeks		X			
30.	Junction Box Drawings	1E	T1+24 weeks		X			
31.	Internal and Interconnecting Wiring Diagram for Instrumentation (Main Skid) and cable list	1E	T1+30 weeks	X				
32.	Deleted	1E	T1+36 weeks	X				
33.	Deleted	1E	T1+16 weeks	X				
34.	Deleted	1E	T1+24 weeks		X			
35.	Instruments Datasheet	1E	T1+24 week	X				
36.	Instrumentation input/output list including alarm and trip list	1E	T1+24 week	X				
37.	Valves, Heat Exchangers, Instrumentation Manifolds and other accessories Datasheet	1E	T2+8 weeks	X				
38.	Lateral and Torsional analysis	1E	T2+16 weeks	X				
39.	Skid Modal Analysis with evaluation of interaction with installation structure	1E	T2+16 weeks	X				
40.	Static and Dynamic Foundation load calculation note with verification of selected anchoring system	1E	T2+12 weeks	X				
41.	CFD study for impact of suction and discharge piping layout to pump performances (if applicable)	1E	T2+8 weeks	X				
42.	Deleted	1E	T2+16 weeks	X				
43.	Deleted	1E	T2+8 weeks	X				
44.	Electrical calculation notes for selection of cable earthing and protective devices	1E	4 weeks prior to manufacturing	X				
45.	Seismic Analytical Analysis Report	1E	T2+8 weeks	X				
46.	Qualification plan (including seismic analysis and other qualification)	1E	T2+4 weeks	X				
47.	Hazard and Risk Analysis Report	1E	T2+8 weeks		X			
48.	Design calculation for insulation and heat tracing	1E	T2+12 weeks		X			
49.	Manufacturing Inspection Plan (MIP)	1E	T2+4 weeks		X			X
50.	Welding book, WPS, PQR including weld repair procedures (if required)	1E	T2+8 weeks		X			
51.	Piping Classes (if different piping classes is applied respect to IO applicable piping classes)	1E	T2+8 weeks	X				
52.	Shake Table Test Procedure (if applicable)	1E	T2+8 weeks		X			
53.	NDE Procedures	1E	T2+8 weeks	X				
54.	Hydrostatic test procedures	1E	T2+8 weeks		X			
55.	Procedure for Mechanical Running Test and Performance Test	1E	T2+8 weeks		X			
56.	Procedure for surface preparation and painting	1E	T2+8 weeks		X			
57.	All other procedures required by MIP	1E	T2+8 weeks		X			
58.	Design Calculation and leak tightness analysis of Bolted	1E	T2+16 weeks	X				

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D#	Deliverable Details	Type and Quantity	Due Date	A	B	C	D	E
	Joint in accordance with EN 1591-1							
59.	Installation Procedure for Main Skid (customized for this project)	1E	T2+16 weeks		X			
60.	Packing and Transportation Procedure	1E	T2+20 weeks		X			
61.	Any document/drawing/procedure that needs prior approval by the IO as mentioned elsewhere in this specification.	1E	T2+8 weeks		X			
62.	Any additional Calculation and Analysis report as required by this specification and by applicable documents, standards and codes	1E	T2+8 weeks	X				
63.	Any document/drawing/procedure that needs prior approval by the IO as mentioned elsewhere in this specification (if any).	1E	8 weeks before MRR		X			
64.	Any additional Calculation and Analysis report as required by this specification and by applicable documents, standards and codes (if any)	1E	8 weeks before MRR	X				
65.	Reliability, Availability, Maintainability and Inspectability (RAMI) Analysis	1E	T2+8 weeks	X				
66.	Calculation Software Model	1E	T2+8 weeks		X			
67.	Calculation software verification note	1E	T2+4 weeks		X			
68.	Request of exclusion from PED of pump pressure casing and ARC valve (& BP valve)	1E	T2 + 4 weeks	X				
69.	Design Reviews Reports	1E	Schedule to be agreed		X			
70.	Manufacturing Readiness Review Report	1E	T2 + 20 weeks	X				
71.	Site Acceptance Test (SAT) procedure	1E	T2+ 20 Weeks	X				
T3 – Start of Manufacturing			Date to be agreed					
72.	Certified Material Test Reports (CMTR)	1E	To be agreed as per material receipt and testing schedule		X			X
73.	Welder's Qualification certificates/reports (if required)	1E	To be agreed as per material receipt and testing schedule		X			
74.	FAT Readiness Review Report	1E	To be agreed as per material receipt and testing schedule		X			
75.	NDE Reports	1E	To be agreed as per material receipt and testing schedule		X			
T4 – Start of Testing			Date to be agreed					
76.	Shake Table Test Report (if applicable)	1E	4 weeks prior to shipment			X		X
77.	Qualification Test Reports, Qualification Summary Report, Qualification Preservation Sheets, Reference Files for entire skid and installed components	1E	4 weeks prior to shipment			X		X
78.	NDE Reports	1E	4 weeks prior to shipment			X		X
79.	Hydrostatic test reports	1E	4 weeks prior to shipment			X		X
80.	Dimensional reports	1E	4 weeks prior to shipment			X		X
81.	Performance Test Reports	1E	4 weeks prior to shipment			X		X
82.	Quality Assurance Data Package (QADP) (Manufacturing Dossier)	2H+1E	4 weeks prior to shipment			X		
83.	Preservation, Storage and Handling Procedures	1E	4 weeks prior to shipment			X		
84.	Spare Parts List (Commissioning and Start-up, Essential 2 year, Capital) for the complete scope of supply (with a format of Appendix XV of GM3S [d1])	1E	4 weeks prior to shipment			X		
85.	Special Tools List	1E	4 weeks prior to shipment			X		
86.	Limits and Precautions	1E	4 weeks prior to shipment			X		
87.	Packaging and Shipping Details	1E	4 weeks prior to shipment		X			X
88.	Deleted	1E	4 weeks prior to shipment		X			
89.	Operation and Maintenance Manual	2H+1E	4 weeks prior to shipment			X		
90.	Deleted	1E	4 weeks prior to shipment			X		
91.	All other Certified Test Report(s) as per agreed MIP	1E	4 weeks prior to shipment			X		X
92.	Certificate of Cleanliness	1E	2 weeks prior to shipment			X		X
93.	CE Declaration of Conformity	1E	4 weeks prior to shipment			X		X
94.	Certificate of Conformance to Purchase Order Requirements	1E	2 weeks prior to shipment			X		X
95.	Engineering Dossier with all approved and As-Built Drawings	1E	2 weeks prior to shipment			X		X
96.	Approved MIP's (signed and completed)	1E	2 weeks prior to shipment			X		X
97.	Approved Test Procedures	1E	2 weeks prior to shipment			X		X

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D#	Deliverable Details	Type and Quantity	Due Date	A	B	C	D	E
98.	All design concession reports if any	1E	1 weeks prior to shipment			X		X
99.	Guarantee and compliance certificates	1E	1 weeks prior to shipment			X		X
100.	Delivery Readiness Review Minute of Meeting	1E	1 weeks prior to shipment			X		
101.	Contractor Shipping Release Note and Delivery report	1E	1 weeks prior to shipment			X		
102.	Packing inspection reports along with photographs before and after packing for identification	1E	4 weeks prior DRR			X		
103.	Safety Risk assessment for works performed onsite	1E	4 weeks prior DRR		X			
T5 - Delivery Readiness Review			Agreed Delivery Date – 1 week					
T6- Delivery DAP ITER Site			Agreed Delivery Date					
104.	Report on Commissioning Activities Performed by Contractor	1E	prior to Equipment Acceptance		X			
105.	Deleted	1E	prior to Equipment Acceptance		X			
T7- Closing of all agreed Project Documentation			Date to be agreed					
T8- Equipment Acceptance after SAT and contract Close-Out			Date to be agreed					

Note:

- Column A – IO acceptance required prior to manufacturing.
- Column B – IO acceptance required prior to use.
- Column C – IO acceptance required prior to shipment.
- Column D – Retained in Contractor's shop and available for IO review.
- Column E – Document included in QA Data Package (QADP), QADP approval prior to shipment.

E – Electronic File (PDF or other accepted format and native file format, for drawings. CD for instruction materials).

H – Hard Copy

SUPPLY

Appendix A1 – CVBD Charging Pump 1 Datasheet

CLIENT:

ITER Organization

PROJECT TITLE:

ITER Project

JOB NUMBER:

EQUIPMENT NUMBER:

26CVBD-PL-5701

EQUIPMENT SERVICE:

CVBD Charging Pump 1

SERIAL NUMBER:

REQ NO. :

G2R52F(Technical Specification for CVBD Charging Pumps (26CVBD- PL- 5701and 26CVBD- PL- 5703))

PURCH ORDER NO.

LATER

Cells colored thus contain drop-down options

Text in BLACK color are by Purchaser

Text in RED color are by Supplier

Text in BLUE color are by Purchaser OR Supplier

COMMENTS:

PUMP

MOTOR

GEAR

TURBINE

DATA SHEETS					
ITEM No.	ATT	ITEM No.	ATT	ITEM No.	ATT
-		-		-	
-		-		-	

APPLICABLE OVERLAY STANDARDS

3	07-Sep-26	ISSUED FOR QUOTATION (Tech Spec v1.3)							
2	26-Aug-26	ISSUED FOR QUOTATION (Tech Spec v1.2)							
1	05-Aug-26	ISSUED FOR QUOTATION (Tech Spec v1.1)							
0	22-Jun-26	ISSUED FOR QUOTATION (Tech Spec v1.0)							
Rev	Date	Description	By	CHK	APPV				
		CANNED MOTOR PUMP DATA SHEET	DATA SHEET No.						
			Annex A1 of G2R52F						
			Sheet	1 of 7					

SUPPLY

CANNED MOTOR PUMP DATA SHEET (API 685 3rd)									
1	Note	APPLICABLE TO: QUOTATION	APPLICABLE STANDARD: API- 685 3rd					Rev	
2		FOR ITER	UNIT: CVBD (Chemical and Volume Control System for IBED-PHTS)						
3		SITE Saint- Paul- lez- Durance, France	Equipment Number / Service: 26CVBD-PL- 5701 / CVBD Charging Pump 1						
4		NO. REQ G2R52F	PUMP SIZE	TYPE: CANNED MOTOR					# STAGES:
5		MANUFACTURER		MODEL		SERIAL NO.:			
LIQUID CHARACTERISTICS (6.1.3)									
7		Units	@ RATED TEMP	@ MAXIMUM TEMP	@ MINIMUM TEMP	Alternate LIQUID			
8		LIQUID TYPE OR NAME:	Demineralized water with hydrazine						
9		PUMPING TEMPERATURE:	°C	50	50	5			
10		VAPOR PRESSURE:	bara	0.124	0.124	0.009			
11		RELATIVE DENSITY (3.163):		0.988	0.988	1.000			
12		SPECIFIC HEAT:	kJ/(kg- K)	4.18	4.18	4.21			
13		VISCOSITY:	Pa s	0.00055	0.00055	0.00152			
OPERATING CONDITIONS (6.1.3) (*2.1) (*2.3)									
16		Units	Rated	Mode1_Plasma (Rated)	Mode1_Plasma (Normal)	Mode2_Baking	Mode3_Idle	Alt 1_Mini_Temp	Alt 3_Parallel run (*2.6)
17									
18		NPSHA Datum:	TGCS Z=18080mm (= 17580mm(B14- L4- 21 TOC) + 500 mm)						
19		PUMPING TEMPERATURE:	°C	50	50	50	50	5	50
20		FLOW :	m³/h	164	164	145	164	162	(Preliminary) 130
21		DISCHARGE PRESSURE (*2.7):	bara	22.3	20.6	11.7	11.4	11.5	
22		SUCTION PRESSURE (*2.4):	bara	4.1	4.1	4.1	1.0	1.0	
23		DIFFERENTIAL PRESSURE:	bar	18.2	16.5	7.6	10.4	10.5	
24		DIFFERENTIAL HEAD (*2.7):	m	187	170	Min. 79	Min. 108	Min. 107	(Preliminary) 208
25		NPSHA (*2.2):	m	51.4	51.4	51.4	19.5	20.4	
26		HYDRAULIC POWER:	kW	82.5	75.0	30.7	47.4	46.8	
SITE AND OPERATING CONDITIONS									
28		SERVICE (CONTINUOUS/INTERMITTENT):	CONTINUOUS		INSTALLATION LOCATION: INDOOR				
29		* IF INTERMITTENT, NO. OF STARTS:			IF INDOOR, TEMPERATURE: MAX: 35 °C MIN: 18 °C				
30		PUMPS OPERATE IN:	ALONE and PARALLEL (*2.6)		ELECTRIC AREA CLASSIFICATION (6.1.29): NONHAZARDOUS				
31		CORROSION DUE TO: (6.10.19)			DIVISION N.A. ZONE N.A.				
32		EROSION DUE TO: (6.10.19)			GROUP N.A.				
33		H2S CONCENTRATION (ppm): (6.10.1.13))			TEMP CLASS N.A.				
34		CHLORIDE CONCENTRATION (ppm):			PUMP VALVE START POSITION: Fully Open Valve				
35		PARTICULATE SIZE (DIA IN MICRONS)	200						
36		PARTICULATE CONCENTRATION (ppm)	TBD						
37		CORROSION ALLOWANCE (6.2.10):	By vendor to meet design life						
38		DESIGN NOTES:	Fouling factor of pumped fluid: 4.0E-05 m2- K/W						
39									
40									
PERFORMANCE					PERFORMANCE—CONTINUED				
42		PROPOSAL CURVENO.	RPM		ROTOR CHAMBER TEMP RISE OPERATING:				
43		As Tested Curve No.			AT RATED CONDITIONS °C				
44		IMPELLER DIA.: RATED MAX. MIN.	mm		AT MAXIMUM PUMP FLOW °C				
45		HYDRAULIC EFFICIENCY AT RATED POINT	%		ROTOR CHAMBER TEMP RISE ON SHUTDOWN: °C				
46		HYSTERESIS & MECHANICAL LOSSES	kW						
47		OVERALL EFFICIENCY (%) (*2.5)	RATED POWER kW		SOUND LEVELS				
48		RATED CURVE BEP FLOW (at rated impeller dia)	m³/h		MAX ALLOWABLE SOUND PRESS. LEVEL (6.120) 85 (dBA)				
49		MIN FLOW: THERMAL STABLE	m³/h		EST MAX SOUND PRESSURE LEVEL (6.120) (dBA)				
50		MAX POWER @ RATED IMPELLER	kW						
51		MAX HEAD @ RATED IMPELLER	m						
52		PERCENT RISE TO SHUTOFF	%						
53		ORIFICE USED TO STEEPEN CURVE OR GIVE CONT. RISE?	(6.116.1)		SYSTEM DESCRIPTION				
54		PREFERRED OPERATING REGION (6.117.1)	to m³/h		SUCTION VESSEL: CLOSED				
55		ALLOWABLE OPERATING REGION (3.12)	to m³/h		PUMP LOCATION: BELOW LIQUID LEVEL				
56		NPSH3 AT RATED FLOW:	m		SUCTION VESSEL ON LEVEL CONTROL? YES				
57		CL PUMP TO U/S BASEPLATE	m		PRESSURE SENSOR ON SUCTION VESSEL? YES				
58		NPSH MARGIN AT RATED FLOW:	m		SUCTION VESSEL PRESSURE MAINTAINED BY LIQUID LEVEL PLUS: FLUID VAPOR PRESSURE				
59		SPECIFIC SPEED (6.118)			IF FLUID LEVEL OR TANK PRESSURE DROPS TOO LOW, WILL SYSTEM AUTOMATICALLY STOP THE PUMP? NO				
60		SUCTION- SPECIFIC SPEED LIMIT	m3/h, rpm, m 12800		WILL THE PUMP RUN DRY IN NORMAL OPERATION? NO				
61		SUCTION- SPECIFIC SPEED (6.118)	m3/h, rpm, m		REMARKS:				
DATA SHEET No. Annex A1 of G2R52F Rev. 3 SHEET 2 of 7									

SUPPLY

CANNED MOTOR PUMP DATA SHEET (API 685 3rd)																																																									
1	Note	CONSTRUCTION				MATERIALS (6.10.1.1)																																																			
2		API PUMP TYPE: [Based on Hydraulic Institute definition] (*3.1)				ANNEX H CLASS A-8																																																			
3		ROTATION (VIEWED FROM COUPLING/DRIVER END) 				CASING & COVER: 																																																			
4		CASING MOUNTING: 				IMPELLER: 																																																			
5		CASING TYPE: 				SHAFT: 																																																			
6		CASE PRESSURE RATING:				WEAR RINGS 																																																			
7		MAWP (6.2.2): 59 barg (=6.0 MPa) @ 100 °C (*3.6)				CONTAINMENT SHELL/STATOR LINER 																																																			
8		HYDROTEST (8.3.2): barg @ °C				INNER MAG SHEATH/ROTOR LINER 																																																			
9		TYPE BOLTING USED ON PUMP (6.138.1) 				BEARING SLEEVE 																																																			
10		NOZZLE CONNECTIONS (6.3.2):				BEARING BUSHING 																																																			
11		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Size</th> <th>Facing</th> <th>Rating</th> <th>Position</th> </tr> </thead> <tbody> <tr> <td>DN150</td> <td>RF</td> <td>300</td> <td>END (*3.1)</td> </tr> <tr> <td>DN150</td> <td>RF</td> <td>600</td> <td>TOP (*3.1) (*3.2)</td> </tr> </tbody> </table>				Size	Facing	Rating	Position	DN150	RF	300	END (*3.1)	DN150	RF	600	TOP (*3.1) (*3.2)	STATOR HOUSING/FRAME 																																							
Size	Facing	Rating	Position																																																						
DN150	RF	300	END (*3.1)																																																						
DN150	RF	600	TOP (*3.1) (*3.2)																																																						
12		SUCTION DISCHARGE (=Outlet of ARC Valve)				INSPECTION CLASS (TABLE 9) CLASS III																																																			
13		FLANGE THICKNESS REQ'D NON-STD BOLT LENGTH (6.3.2.3): YES				MIN DESIGN METAL TEMP (6.10.4.1) °C at barg																																																			
14		PRESSURE CASING AUX. CONNECTIONS: (6.3.3)				IMPACT TEST SPECIFICATION 																																																			
15		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>No.</th> <th>Size</th> <th>Type</th> <th>Facing</th> <th>Rating</th> <th>Posn.</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td>BW</td> <td>RF</td> <td>600</td> <td>END (*3.2)</td> </tr> <tr> <td></td> <td></td> <td>(BW)</td> <td>(RF)</td> <td>(600)</td> <td>(TOP) (*3.3)</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td>BW</td> <td>RF</td> <td>600</td> <td>END (*3.2)</td> </tr> <tr> <td></td> <td></td> <td>DN150</td> <td>BW</td> <td>RF</td> <td>300 SIDE (*3.2) (*3.3)</td> </tr> </tbody> </table>				No.	Size	Type	Facing	Rating	Posn.			BW	RF	600	END (*3.2)			(BW)	(RF)	(600)	(TOP) (*3.3)																					BW	RF	600	END (*3.2)			DN150	BW	RF	300 SIDE (*3.2) (*3.3)	REDUCED-HARDNESS MATERIALS REQ'D (6.10.1.14) 			
No.	Size	Type	Facing	Rating	Posn.																																																				
		BW	RF	600	END (*3.2)																																																				
		(BW)	(RF)	(600)	(TOP) (*3.3)																																																				
		BW	RF	600	END (*3.2)																																																				
		DN150	BW	RF	300 SIDE (*3.2) (*3.3)																																																				
16		PURGE/FLUSH OUT (asper 9.2.2.11) 				APPLICABLE HARDNESS STANDARD (6.10.1.14) 																																																			
17		DRAIN 				COPPER IN CONTACT w/ PROCESS FLUIDS (6.10.1.19) 																																																			
18		VENT 				PRESSURE VESSEL DESIGN CODE REFERENCES																																																			
19		PRESS SENSOR 																																																							
20		TEMP SENSOR 																																																							
21		WARM-UP LINE 																																																							
22		EXTERNAL 				WELDING AND REPAIRS																																																			
23		2ND DRAIN (as per 6.7.9) 																																																							
24		Bypass of ARC valve 																																																							
25		GUSSET SUPPORT REQUIRED (6.3.3.11) YES																																																							
26		DRAIN CONNECTION FOR SECONDARY CASING (6.7.9) YES (*3.2)				ALTERNATE WELDING CODES AND STANDARDS (6.10.3.1) TABLE 7 (STD)																																																			
27		ROTOR CAVITY NOT COMPLETELY DRAINABLE (6.3.3.8) 																																																							
28		DRAIN VALVE SUPPLIED BY: SUPPLIER																																																							
29		VENT VALVE SUPPLIED BY: (SUPPLIER) (*3.3)																																																							
30		THREADED CONNECTIONS TO SECONDARY CASING: NOT ALLOWED				ALTERNATE STANDARD / ACCEPTANCE CRITERIA (8.2.2) TABLE 10																																																			
31		SPECIAL FITTINGS FOR TRANSITIONING (6.3.3.4) 																																																							
32		CYLINDRICAL THREADS REQUIRED (6.3.3.1) N/A																																																							
33		MACHINED AND STUDDED CONNECTIONS (6.3.3.7) 																																																							
34		AUXILIARY CIRCULATION PIPING PLAN (ANNEX B)				MOTOR REQUIREMENTS APPLICABLE TO ALL (7.1.2)																																																			
35		PIPING TYPE/THICKNESS: 																																																							
36		PIPING MATERIAL: 																																																							
37		PIPING ASSEMBLY 																																																							
38		IF FLANGED, 				MANUFACTURER 																																																			
39		COOLING WATER REQUIREMENTS: NOT APPLICABLE (*3.4)																																																							
40		COOLING WATER PIPING PLAN 																																																							
41		PIPING TYPE: 																																																							
42		PIPING MATERIAL: 				FRAME AND/OR MODEL 																																																			
43		PIPING ASSEMBLY																																																							

SUPPLY

CANNED MOTOR PUMP DATA SHEET (API 685 3rd)		Rev
1	Note	
2	MAGNETIC DRIVEN PUMP SPECIFIC (9.1)	CANNED MOTOR PUMP SPECIFIC (9.2) (*4.8)
3	DRIVER TYPE _____ GEAR REQ'D: _____	MOTOR WINDING INSULATION CLASS (9.2.2.8) _____ H
4	CLOSE COUPLED DESIGN APPROVED: (9.1.12) _____	SOLID OR LIQUID HEAT TRANS. MEDIA ALLOWED IN STATOR? _____
5	DESIGN FOR REMOVAL OF DRIVE END WITHOUT DISTURBING THE _____	DESIGN MOTOR FOR FREQUENT STARTS (9.2.2.9) _____ YES
6	PRESSURE CASING OR DRIVER (9.1.14) _____	STARTS PER _____
7	DESIGN CONTAINMENT SHELL FOR VACUUM (6.2.9) _____	IMPACT ON LIFE: _____
8	CONTAINMENT SHELL VACUUM DESIGN: _____ barg	DESIGN MOTOR FOR: (9.2.2.9) _____ FIXED SPEED
9	MAGNETIC COUPLING TYPE (9.1.3.1): _____	UL, FM, ATEX OR EQUIVALENT REQUIRED (9.2.2.10) _____
10	MAGNETS:	CERTIFICATION OF IEEE 252 TEST REQUIRED (9.2.8.2) _____ YES
11	MAG. MATERIAL	DESIGN STATOR LINER FOR VACUUM (6.2.9) _____
12	MOUNT. METHOD	STATOR LINER VACUUM DESIGN: _____ barg
13	TEMP. LIMIT, °C	DECONTAMINATION CONNECTION ON STATOR (9.2.2.11) _____ YES
14	HERMETIC. SEALED	TEMPERATURE SENSING ELEMENT IN EACH PHASE (9.2.2.12) (*4.2)(*4.3) _____ YES
15	NO. OF MAGNETS	
16	PROTECTION OF OUTER MAG RING (9.1.3.6): _____	
17	STARTING REQUIREMENT (9.1.3.8): _____	
18	TORQUE RATING (DECOUPLING) _____ N-m	
19	MAX TORQUE REQ'D ON STARTING _____ N-m	
20	PUMP TORQUE AT RATED (+5%) _____ N-m	
21	DESIGN FOR FULL CURVE TORQUE REQ'TS _____	
22	TORQUE REQ'D FOR FULL CURVE (120% BEP) _____ N-m	
23	REQUIRED/ACTUAL SERVICE FACTOR (TABLE 12) _____	
24	MAG. COUPLING TORQUE VS TEMP. CURVE REQ'D (9.1.3.10) _____	
25	SPEED VS TORQUE CURVE REQ'D (9.1.3.11) _____	
26	BEARINGS AND LUBRICATION (9.1.4)	
27	DRIVE MAGNET BEARING (TYPE/NUMBER): _____	
28	RADIAL _____ / _____	
29	THRUST _____ / _____	
30	LUBRICATION METHOD: _____	
31	OIL VISC. ISO GRADE _____ VG _____	
32	CONSTANT LEVEL OILER: (9.1.4.2.1) _____	
33	MODEL SPECIFIED: _____	
34	OILER VENT LOCATION _____	
35	SUMP COLLECTOR REQUIRED (9.1.4.2.3) _____	
36	BEARING HOUSING SEAL TYPE (9.1.4.2.7) _____	
37	SHAFT COUPLING & GUARD: (9.1.5.2)	
38	COUPLING MANUFACTURER: _____	
39	MODEL _____ SPACER LENGTH _____ mm	
40	RATING (POWER/100 RPM) _____ SERVICE FACTOR _____	
41	COUPLING BALANCED TO ISO 21940-11 G6.3 (9.1.5.2.3) _____	
42	COUPLING TO ISO 14691 (9.1.5.2.8) _____	
43	COUPLING GUARD STANDARD (9.1.5.2.11.2) _____	
44	IGNITION HAZARD ASSESSMENT REQUIRED (9.1.5.2.11.6) _____	
45	SPARK-RESISTANT MATERIAL (9.1.5.2.11.7) _____	
46	BASEPLATE (9.1.5.3) (*4.1)	
47	BASEPLATE CONSTRUCTION (9.1.5.3.1) _____ FULL TOP DECKING	
48	BASEPLATE DRAINAGE (9.1.5.3.1.2) _____ DRAIN PAN	
49	MOUNTING: _____ On Embedded Plates (EPs)	
50	NONGROUT CONSTRUCTION: (9.1.5.3.1e) _____ REQUIRED	
51	PROVIDE STAINLESS SPACER PLATE UNDER ALL EQUIPMENT _____	
52	FEET (9.1.5.3.5.3) _____ REQUIRED	
53	OTHER _____ Baseplate drain shall be ended with a blind flange.	
54	SEPARATE MOTOR DRIVER (SEE MOTOR DATA SHEET FOR DETAILS)	
55	APPLICABLE SPEC: _____	
56	ENCLOSURE _____	
57	INCLUDE: SPACE HEATER _____ VIB. SENSOR _____	
58	LUBRICATION: _____	
59	DRIVE MOTOR BEARING (TYPE/NUMBER): _____	
60	RADIAL _____ / _____	
61	THRUST _____ / _____	
62		

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1	Note	SURFACE PREPARATION AND PAINT (8.4.5.6)				INSPECTION AND TESTING	Rev	
2		MANUFACTURER'S STANDARD User Specified				GENERAL (8.1)		
3		SPEC. NO. <u>Refer to 9.6.4/9.6.5/9.6.6 of Pump Tech Spec(G2R52F)</u>				DAYS ADVANCED NOTIFICATION OF WITNESSED OR OBSERVED		
4						TESTS AND INSPECTIONS REQUIRED: _____ DAYS		
5		PUMP:				NOTIFICATION OF SUCCESSFUL PRELIMINARY SHOP		
6		PUMP SURFACE PREPARATION _____				PERFORMANCE TEST (8.11.3) REQUIRED		
7		PRIMER _____				SUBMIT INSPECTION CHECKLIST (8.16) REQUIRED		
8		FINISH COAT _____						
9								
10		BASEPLATE:				SHOP INSPECTION (8.2)		
11		BASEPLATE SURFACE PREPARATION _____				ADDNL SUBSURFACE EXAMINATION (6.10.16) (8.2.1.4) YES (*5.1)		
12		PRIMER: _____				PART _____ EXAM _____		
13		FINISH COAT _____				PART _____ EXAM _____		
14						PART _____ EXAM _____		
15		PREPARATION FOR SHIPMENT: (8.4.5)				PART _____ EXAM _____		
16		TYPE OF SHIPMENT: (8.4.3 & 8.4.4) EXPORT				PM TESTING REQUIRED (8.2.3.3) REQUIRED		
17		EXPORT BOXING USER SPEC REQUIRED				PARTS TO BE TESTED <u>For materials with Type 2.2 Certificate as minimum</u>		
18		SPEC. NO. <u>Refer to 13.4 & 13.5 of Pump Tech Spec(G2R52F)</u>				INSPECTION REQUIRED FOR CASTINGS (8.2.2.1)		
19		OUTDOOR STORAGE MORE THAN 6 MONTHS YES				MAG PARTICLE Refer to Table 9 (Calss III) of API 685 3rd and 11.3 of Pump Tech Spec(G2R52F).		
20						RADIOGRAPHY _____		
21						LIQUID PENETRANT _____		
22		DETAILS OF LIFTING DEVICES (8.4.7)				ULTRASONIC _____		
23						INSPECTION REQUIRED FOR CONNECTION WELDS (6.10.3)		
24		SPARE PARTS (include cost & details w/ proposal)				MAG PARTICLE Refer to Table 9 (Calss III) of API 685 3rd and 11.3 of Pump Tech Spec(G2R52F).		
25		START-UP				LIQUID PENETRANT _____		
26		NORMAL MAINTENANCE				RADIOGRAPHY _____		
27		SPARE ASSEMBLY: For spare parts, refer to 5.1.4 of Pump Tech Spec(G2R52F).				ULTRASONIC _____		
28		OTHER: _____				CLEANLINESS PRIOR TO FINAL ASSEMBLY (8.2.3.1) WIT		
29		WEIGHTS (kg)				TESTING (8.3)		
30		ITEM No	PUMP	DRIVER	GEAR	BASE	TOTAL	HARDNESS TEST REQUIRED (8.2.3.2) NOT REQUIRED
31								FOR: _____
32								METHOD: _____
33								COMPONENTS TO BE TESTED: _____
34								IMPACT TEST - TO _____
35		OTHER PURCHASER REQUIREMENTS						HYDROSTATIC (8.3.2) WITNESSED
36								WETTING AGENT INCLUDED (8.3.2.7) _____
37		CASTING REPAIR WELD PROCEDURE APPR REQD (6.10.2.5) YES						PERFORMANCE TEST (8.3.3) WITNESSED
38		MAXIMUM DISCHARGE PRESSURE TO INCLUDE (6.2.2):						TEST DATA POINTS- PER 8.3.3.3
39		MAX RELATIVE DENSITY YES						PERFORMANCE CURVE & DATA APPROVAL PRIOR
40		OPERATION TO TRIP SPEED YES						TO SHIPMENT (8.3.3.3.5) REQUIRED
41		MAX DIA. IMPELLERS YES						TEST W/ NPSHA LIMITED TO 110 % SITE NPSHA REQUIRED
42		CONNECTION DESIGN APPROVAL (6.10.3.4.5) YES						RUN UNTIL TEMP STABILIZATION ACHIEVED (9.16.3) N.A.
43		DEMONSTRATE CO- PLANAR MOUNTING PAD SURFACES						4 HR. MECH RUN TEST (8.3.4.2) WITNESSED
44		IN PUMP VENDOR SHOP (9.15.3.4.4) WIT						
45		DYNAMIC BALANCE TO ISO 21940- 11GR. G10 (6.8.6.2) NO						NPSH3 TEST (8.3.4.3) WITNESSED
46								COMPLETE UNIT TEST (8.3.4.4) WITNESSED
47								SOUND LEVEL TEST (8.3.4.5) WITNESSED
48		CONNECTION BOLTING COATING _____						AUXILIARY EQUIPMENT TEST (8.3.4.6) NONE
49		SUBMIT EST. SPL BY OCTAVE BAND (6.120.1) REQUIRED						SECONDARY CONTAIN SYSTEM HYDRO (8.3.4.7) WITNESSED
50		MATERIAL CERTIFICATION REQUIRED (6.10.1.8)						SECONDARY CONTAINMENT/CONTROL SYSTEM INSTRUMENT
51		CASING	YES					TEST (8.3.4.8) WITNESSED
52		IMPELLER	YES					STATIC TORQUE TEST (9.16.1) N.A.
53		SHAFT	YES			Refer to 11.1 of Pump Tech Spec(G2R52F)		RUN UNTIL OIL TEMP STABILIZED (9.16.3) N.A.
54		OTHER	YES	SPECIFY PART				RESIDUAL UNBALANCE TEST (J.4.12) _____
55		VENDOR SUBMIT TEST PROCEDURES (8.3.1.1) REQUIRED						OTHER _____
56		ADDITIONAL DATA REQUIRING 20 YEARS RETENTION (8.2.1.1):						
57								
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CANNED MOTOR PUMP DATA SHEET (API 685 3rd)

1	Note	EQUIPMENT CLASSIFICATION										Rev
2		PIC/ Safety Class (*6.2)	Quality Class	HCC	PED class (*6.1)	ESPN class (*6.1)	Seismic class (*6.10)	Vacuum class	Tritium Class	RH class		
3												3
4		SIC- 1	QC- 1	NO	TBD	N2	SC1(S)	N/A	N/A	N/A		
5												
6												
7		REGULATION										
8		MACHINERY - REGULATION (EU) 2023/1230										
9		PRESSURE EQUIPMENT - DIRECTIVE 2014/68/EU										
10		ELECTROMAGNETIC COMPATIBILITY - DIRECTIVE 2014/30/EU										
11		LOW VOLTAGE - DIRECTIVE 2014/35/EU										
12		ATEX - DIRECTIVE 2014/34/EU										
13												
14		ENVIRONMENTAL CONDITIONS										
15												
16		Range of Ambient Conditions (*6.3)		Normal Conditions (*6.5)		Degraded Conditions		Storage (*6.5)		Fire (*6.8)		
17	MIN			MAX	Category II.S1(DEC1)	Category III.S1(DEC2)	Indoor	Outdoor	Insulated	non-Insulated		
18		RANGE OF AMBIENT TEMPS [°C]		18	35	5- 100	5- 130	- 8 to 45	- 25 to +45	188	400	3
19		RELATIVE HUMIDITY [%]		0	60	0 to 100		0 to 100				
20		ATMOSPHERIC PRESSURE [kPaA]		95	105	95 to 200		atm		105	105	
21												
22		Room Specific Radiation and Static Magnetic Field		Radiations (*6.4)					Static Magnetic Field Max Modulus [mT] (*6.7)			
23	TID (Total Ionizing Dose) for 20 Years [kGy] (*6.6)			Average TID over 4700 hrs [kGy/hr] (*6.6)	ENF (Equivalent Neutron Fluence) [n/cm2](1MeVeq.)	TNF (Total Neutron flux) [n/cm2/s]						
24		(To silicon) 0.13		(To silicon) 2.7E- 05		1.1E+07		27		8.4		
25		(To polymer) 0.12		(To polymer) 2.6E- 05								
26												
27												
28												
29		UTILITIES										
30		Cooling water for Auxiliary heat exchanger and/or jacket cooler (*6.9)										
31		Type : Cooling Water from CCWS- 1system (PBS 26)										
32		Unit	Min	Normal	Max	Design	Fluid parameter : Cooling Water from CCWS- 1system (PBS 26)					
33		Temperature	°C	Not applicable (*3.4)			Conductivity @ 25 °C	µS/cm	Not applicable (*3.4)			
34		Temperature rise	°C									
35		Pressure	bar g									
36		Pressure drop	bar									
37		Allowable flow	kg/s									
38		Required flow	kg/s									
39		Fouling factor	m2/K/W				Total Organic Content	µg/kg				
40		(Required flow to be filled by Contractor)						Dissolved Oxygen				µg/kg
41								Silica				µg/kg
42								Sodium				µg/kg
43								Particulate Size	µm			
44								Particulate Concentration	ppb			
45								During commissioning stage, the coolers shall be capable to operate with suspended solid particle size up to 1mm				
46		Power rating for electrical equipment										
47		Voltage[V]	Frequency[Hz]	Phase[-]								
48		MV Motor (*3.5)	6600	50	3	For Motor > 200 kw						
49		LV Motor	400	50	3	For Motor ≤ 200kw						
50		Space Heater	230(400)	50	3							
51		Control	24 V DC									
52		Instrumentation	24 V DC									
53		UPS	400(230)	50	3							
54												

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CANNED MOTOR PUMP DATA SHEET (API 685 3rd) - NOTES

1	Note	Rev
2	(*2.1) In addition, refer to annex C of Pump Tech Spec (G2R52F) for full range of operating temperature and pressure, including accidental conditions.	
3	(*2.2) NSPHA - NPSH3 shall not be less than 1 meter at rated point and shall not be negative at the end of curve.	
4	(*2.3) The pump shall be rated based on Mode 1 Plasma (Rated), with all of other cases remaining within the allowable operating range of the selected performance curve.	3
5	Differential heads at Mode 2_Baking, Mode 3_Idle and Alt 1_Mini_Temp shall be minimum 79m, 108m and 107m respectively.	3
6	(*2.4) Maximum suction pressure : 11.34 BarG (Refer to 9.3.2.h of Pump Tech Spec (G2R52F)).	
7	Maximum limit of shut-off head (preliminary) : 449.8 m (when max test tolerance (@ shut-off) is +8%)	
8	(*2.5) Requirement of minimum pump efficiency at the rated point : 33% (not mandatory, but preferable)	
9	(*2.6) The pump normally operates alone, but operates in parallel with PL-5703 for a short period during transient operation, as specified in Annex B of 8PZBTB[r6].	
10	Head@130m ³ /h for PL-5701 shall be equal to or higher than Head@34m ³ /h for PL-5703. Head&Flow for parallel run will be adjusted and finalized after purchase order.	
11	(*2.7) Contractor shall add pressure loss of ARC valve to the pump head so that discharge pressure indicated is equal to outlet pressure of ARC valve.	3
12	(*3.1) A horizontal pump with end suction and top discharge nozzles is currently expected for this pump (26CVBD- PL- 5701).	
13	If pump nozzles do not match flange sizes specified, Contractor shall provide nozzle reducers (as per 9.4.3.m and table 10 of Pump Tech Spec (G2R52F)).	
14	(*3.2) Drains shall be collected to single terminal point, including primary casing and secondary casing (as per 9.5.1.k and table 10 of Pump Tech Spec (G2R52F)).	
15	(*3.3) All internal cavities of pump shall be completely self-venting, as vent piping has not been currently planned by IO. When manual venting	
16	or reverse circulation is not avoidable, Contractor shall clearly state it in the Proposal (as per 9.4.3.s of Pump Tech Spec (G2R52F)).	
17	(*3.4) Non-cooling water type is strongly recommended for this pump (26CVBD-PL-5701) (as per 9.5.1.g of Pump Tech Spec (G2R52F)).	
18	(*3.5) This pump (26CVBD-PL-5701) shall be rated as medium voltage, assuming that the motor rating is larger than 200kw (as per 9.7.2.a of Pump Tech Spec (G2R52F)).	
19	(*3.6) Design conditions for process piping. Contractor shall consider this for both suction and discharge regions as dual pressure ratings as minimum.	
20	(*3.7) ARC valve shall be installed directly on pump discharge flange vertically (as per 9.5.8 of Pump Tech Spec (G2R52F)).	3
21	(*4.1) This part (9.15.3) shall be applicable for Canned Motor Pump. The baseplate and anchoring system shall follow 9.5.7 of Pump Tech Spec (G2R52F).	
22	(*4.2) Instrument alarm/trip philosophy shall be recommended by Contractor and mutually agreed with IO, based on their field proven experiences.	
23	(*4.3) Motor winding : 1Dual RTD per phase.	
24	(*4.4) Contractor shall propose an appropriate detection from either pressure sensor (PE) or liquid sensor (LE2) for effective primary leakage monitoring.	
25	(*4.5) Contractor shall propose an appropriate location of temperature monitoring among stator liner, containment shell and returned circulation fluid,	
26	in terms of effective primary leakage monitoring (and potential bearing condition monitoring).	
27	(*4.6) Vibration sensors shall be radiation resistant piezoelectric accelerometer (as per 5.2.16 of Y6R3VX [d65]).	
28	(*4.7) The following instrument shall be provided for monitoring proper pump operation for each pump.	
29	- An instrument (portable & use for commissioning only) that indicates that the rotor is rotating in the correct direction (9.2.2.B of API 685 3rd).	
30	- Bearing wear detector or shaft position sensor, monitoring bearing conditions remotely with alarm function (9.2.5 of API 685 3rd).	
31	(*4.8) If the motor design shall be modified from conventional design to meet the environmental conditions (including radiations, static magnetic field	
32	and fire case, see details in sheet 7) such as filling a liquid or solid material in the stator cavity or using a special type of motor winding,	
33	Contractor shall state the modification plan together with technical justification in their proposal and agree with IO before Purchase order.	
34	(*4.9) Unless otherwise permanent signal converter (containing semiconductor such as transducer, transmitter) for any instrument is qualified for the	
35	environmental conditions including radiation and neutron, they shall be installed in the safe area (inside Remote IO cabinet supplied by IO) and supplied as loose.	
36	For vibration sensors, output signal from the permanent signal converter shall be 4-20mA.	
37		
38	(*5.1) The secondary pressure casing shall be inspected to the same inspection class as primary casing (=Class III in Table 9 of API 685 3rd).	
39		
40	(*6.1) Contractor shall present a request of exclusion for PED&ESPN to be applied to pump pressure boundary. PED&ESPN class will be applied case by case depending	
41	the auxiliary component. N2 ESPN class is the classification of piping connected to inlet and discharge nozzle, while ARC valve is classified as N3 ESPN.	3
42	(*6.2) SIC- 1 For Confinement Only.	
43	(*6.3) Source of references: Appendix C of Pump Tech Spec (G2R52F), TCWS CVBD Process Loading Condition (8PZBTB[r6])	
44	(*6.4) Source of references: Radiation environment for equipment during operations (3FM52L[d11])	
45	(*6.5) Contractor shall consider outdoor storage before installation and indoor storage during installation. Normal condition to be also applied to	
46	activities and storage time after installation during commissioning.	
47	(*6.6) TID (Total Ionizing Dose) are referred to silicon and polymer dose. Installation life is 20 years, but total irradiation time is 4700 h.	
48	Irradiation by ENF (Equivalent Neutron Fluence) and TNF (Total Neutron flux) shall be considered for Electronic Devices.	
49	(*6.7) Qualification testing shall to be performed with a field strength that is 1.4 times these current field values.	
50	Values of static magnetic field Modulus have been calculated using Tool in reference of 53KMVD[r14].	
51	For detailed composition of magnetic field, refer to maps (Level L4 tokamak complex) in references QUDEGC[r21].	
52	(*6.8) These fire temperatures shall be considered as a static condition for the Main pumps (pumps not running).	
53	These two temperature values are referred to the maximum temperature under fire insulation (insulated) and maximum	
54	temperature of surfaces not covered by fire insulation (non-insulated).	
55	(*6.9) Deleted	
56	(*6.10) Pump shall be SC1(S), while ARC valve (with BP valve) shall be SC1(SF) to maintain check valve functionality during an earthquake.	3
57		

DATA SHEET No.

Annex A1 of G2R52F

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SUPPLY

Appendix A2 – CVBD Charging Pump 2 Datasheet

CLIENT:

ITER Organization

PROJECT TITLE:

ITER Project

JOB NUMBER:

EQUIPMENT NUMBER:

26CVBD-PL-5703

EQUIPMENT SERVICE:

CVBD Charging Pump 2

SERIAL NUMBER:

REQ NO. :

G2R52F(Technical Specification for CVBD Charging Pumps (26CVBD- PL- 5701and 26CVBD- PL- 5703))

PURCH ORDER NO.

LATER

Cells colored thus contain drop-down options

Text in BLACK color are by Purchaser

Text in RED color are by Supplier

Text in BLUE color are by Purchaser OR Supplier

For clarity, any differences from 26CVBD-PL-5701 are highlighted in pink in this data sheet.

COMMENTS:

PUMP

MOTOR

GEAR

TURBINE

DATA SHEETS					
ITEM No.	ATT	ITEM No.	ATT	ITEM No.	ATT
-		-		-	
-		-		-	

APPLICABLE OVERLAY STANDARDS

3	07-Sep-26	ISSUED FOR QUOTATION (Tech Spec v1.3)							
2	26-Aug-26	ISSUED FOR QUOTATION (Tech Spec v1.2)							
1	05-Aug-26	ISSUED FOR QUOTATION (Tech Spec v1.1)							
0	22-Jun-26	ISSUED FOR QUOTATION (Tech Spec v1.0)							
Rev	Date	Description	By	CHK	APPV				
CANNED MOTOR PUMP DATA SHEET			DATA SHEET No.						
			Annex A2 of G2R52F						
			Sheet	1 of 7					

SUPPLY

CANNED MOTOR PUMP DATA SHEET (API 685 3rd)							
1	Note	APPLICABLE TO: QUOTATION	APPLICABLE STANDARD: API- 685 3rd			Rev	
2		FOR ITER	UNIT: CVBD (Chemical and Volume Control System for IBED-PHTS)				
3		SITE Saint- Paul- lez- Durance, France	Equipment Number / Service: 26CVBD- PL- 5703 / CVBD Charging Pump 2				
4		NO. REQ G2R52F	PUMP SIZE	TYPE: CANNED MOTOR		# STAGES:	
5		MANUFACTURER		MODEL		SERIAL NO.:	
LIQUID CHARACTERISTICS (6.1.3)							
7		Units	@ RATED TEMP	@ MAXIMUM TEMP	@ MINIMUM TEMP	Alternate LIQUID	
8		LIQUID TYPE OR NAME:	Demineralized water with hydrazine				
9		PUMPING TEMPERATURE:	°C	50	50	5	
10		VAPOR PRESSURE:	bara	0.124	0.124	0.009	
11		RELATIVE DENSITY (3.163):		0.988	0.988	1.000	
12		SPECIFIC HEAT:	kJ/(kg- K)	4.18	4.18	4.21	
13		VISCOSITY:	Pa s	0.00055	0.00055	0.00152	
OPERATING CONDITIONS (6.1.3) (*2.1) (*2.3)							
16		Units	Rated Mode 2_Baking (Rated)	Mode 2_Baking (Normal)	Alt 1_Mini_Temp	Alt 2_Min_Suc Pre	Alt 3_Parallel run (*2.6)
18		NPSHA Datum:	TGCS Z=18480 mm (= 17580mm(B14- L4- 21 TOC) + 900 mm)				
19		PUMPING TEMPERATURE:	°C	50	50	5	50
20		FLOW:	m³/h	18	18	18	18 (Preliminary) 34
21		DISCHARGE PRESSURE (*2.7):	bara	38.6	35.5	39.0	35.5
22		SUCTION PRESSURE (*2.4):	bara	4.0	4.0	4.0	0.9
23		DIFFERENTIAL PRESSURE:	bar	34.6	31.4	35.0	34.6
24		DIFFERENTIAL HEAD (*2.7):	m	356	324	356	356 (Preliminary) 208
25		NPSHA (*2.2):	m	50.6	50.6	51.2	18.7
26		HYDRAULIC POWER:	kW	17.4	15.9	17.4	17.4
SITE AND OPERATING CONDITIONS							
28		SERVICE (CONTINUOUS/INTERMITTENT):	INTERMITTENT		INSTALLATION LOCATION: INDOOR		
29		• IF INTERMITTENT, NO. OF STARTS:	1500		IF INDOOR, TEMPERATURE: MAX: 35 °C MIN: 18 °C		
30		PUMPS OPERATE IN:	ALONE and PARALLEL (*2.6)		ELECTRIC AREA CLASSIFICATION (6.1.29): NONHAZARDOUS		
31		CORROSION DUE TO: (6.10.19)			DIVISION N.A. ZONE N.A.		
32		EROSION DUE TO: (6.10.19)			GROUP N.A.		
33		H2S CONCENTRATION (ppm): (6.10.1.13))			TEMP CLASS N.A.		
34		CHLORIDE CONCENTRATION (ppm):			PUMP VALVE START POSITION: Fully Open Valve		
35		PARTICULATE SIZE (DIA IN MICRONS)	200				
36		PARTICULATE CONCENTRATION (ppm)	TBD				
37		CORROSION ALLOWANCE (6.2.10):	By vendor to meet design life				
38		DESIGN NOTES:	Fouling factor of pumped fluid: 4.0E-05 m2- K/W				
PERFORMANCE							
42		PROPOSAL CURVENO.	RPM		PERFORMANCE—CONTINUED		
43		As Tested Curve No.			ROTOR CHAMBER TEMP RISE OPERATING:		
44		IMPELLER DIA.: RATED MAX. MIN.	mm		AT RATED CONDITIONS °C		
45		HYDRAULIC EFFICIENCY AT RATED POINT	%		AT MAXIMUM PUMP FLOW °C		
46		HYSTERESIS & MECHANICAL LOSSES	kW		ROTOR CHAMBER TEMP RISE ON SHUTDOWN: °C		
47		OVERALL EFFICIENCY (%) (*2.5)	RATED POWER kW		SOUND LEVELS		
48		RATED CURVE BEP FLOW (at rated impeller dia	m³/h		MAX ALLOWABLE SOUND PRESS. LEVEL (6.120) 85 (dBA)		
49		MIN FLOW: THERMAL STABLE	m³/h		EST MAX SOUND PRESSURE LEVEL (6.120) (dBA)		
50		MAX POWER @ RATED IMPELLER	kW		SYSTEM DESCRIPTION		
51		MAX HEAD @ RATED IMPELLER	m		SUCTION VESSEL: CLOSED		
52		PERCENT RISE TO SHUTOFF	%		PUMP LOCATION: BELOW LIQUID LEVEL		
53		ORIFICE USED TO STEEPEN CURVE OR GIVE CONT. RISE?	(6.116.1)		SUCTION VESSEL ON LEVEL CONTROL? YES		
54		PREFERRED OPERATING REGION (6.117.1)	to m³/h		PRESSURE SENSOR ON SUCTION VESSEL? YES		
55		ALLOWABLE OPERATING REGION (3.12)	to m³/h		SUCTION VESSEL PRESSURE MAINTAINED BY LIQUID LEVEL PLUS: FLUID VAPOR PRESSURE		
56		NPSH3 AT RATED FLOW:	m		IF FLUID LEVEL OR TANK PRESSURE DROPS TOO LOW, WILL SYSTEM		
57		CL PUMP TO U/S BASEPLATE	m		AUTOMATICALLY STOP THE PUMP? NO		
58		NPSH MARGIN AT RATED FLOW:	m		WILL THE PUMP RUN DRY IN NORMAL OPERATION? NO		
59		SPECIFIC SPEED (6.118)			REMARKS:		
60		SUCTION- SPECIFIC SPEED LIMIT	m3/h, rpm, m 12800				
61		SUCTION- SPECIFIC SPEED (6.118)	m3/h, rpm, m				
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CANNED MOTOR PUMP DATA SHEET (API 685 3rd)		Rev
1	Note	
2	MAGNETIC DRIVEN PUMP SPECIFIC (9.1)	CANNED MOTOR PUMP SPECIFIC (9.2) (*4.8)
3	DRIVER TYPE GEAR REQ'D:	MOTOR WINDING INSULATION CLASS (9.2.2.8) H
4	CLOSE COUPLED DESIGN APPROVED: (9.1.12)	SOLID OR LIQUID HEAT TRANS. MEDIA ALLOWED IN STATOR?
5	DESIGN FOR REMOVAL OF DRIVE END WITHOUT DISTURBING THE PRESSURE CASING OR DRIVER (9.1.14)	DESIGN MOTOR FOR FREQUENT STARTS (9.2.2.9) YES
6	DESIGN CONTAINMENT SHELL FOR VACUUM (6.2.9)	STARTS PER
7	CONTAINMENT SHELL VACUUM DESIGN: barg	IMPACT ON LIFE:
8	MAGNETIC COUPLING TYPE (9.1.3.1):	DESIGN MOTOR FOR: (9.2.2.9) FIXED SPEED
9	MAGNETS:	UL, FM, ATEX OR EQUIVALENT REQUIRED (9.2.2.10)
10	MAG. MATERIAL	CERTIFICATION OF IEEE 252 TEST REQUIRED (9.2.8.2) YES
11	MOUNT. METHOD	DESIGN STATOR LINER FOR VACUUM (6.2.9)
12	TEMP. LIMIT, °C	STATOR LINER VACUUM DESIGN: barg
13	HERMETIC. SEALED	DECONTAMINATION CONNECTION ON STATOR (9.2.2.11) YES
14	NO. OF MAGNETS	TEMPERATURE SENSING ELEMENT IN EACH PHASE (9.2.2.12) (*4.2)(*4.3) YES
15	PROTECTION OF OUTER MAG RING (9.1.3.6):	
16	STARTING REQUIREMENT (9.1.3.8):	SECONDARY CONTROL / CONTAINMENT
17	TORQUE RATING (DECOUPLING) N-m	NFPA RATING: HEALTH FLAMMABILITY INSTABILITY
18	MAX TORQUE REQ'D ON STARTING N-m	USE ANNEX P HAZARD-BASED PROCEDURE
19	PUMP TORQUE AT RATED (+5%) N-m	HAZARD STATEMENT HAZARD GROUP
20	DESIGN FOR FULL CURVE TORQUE REQ'TS	RISK PHRASE
21	TORQUE REQ'D FOR FULL CURVE (120% BEP) N-m	REQUIRED MEASURE: SECONDARY CONTAINMENT SYSTEM
22	REQUIRED/ACTUAL SERVICE FACTOR (TABLE 12) /	SECONDARY CONTROL (6.7)
23	MAG. COUPLING TORQUE VS TEMP. CURVE REQ'D (9.1.3.10)	MAX LEAKAGE ON PRIMARY FAILURE: m³/h
24	SPEED VS TORQUE CURVE REQ'D (9.1.3.11)	FLOW RESTRICTION:
25	BEARINGS AND LUBRICATION (9.1.4)	DEVICE MANUFACTURER
26	DRIVE MAGNET BEARING (TYPE/NUMBER):	MATERIAL
27	RADIAL /	ELASTOMERS
28	THRUST /	MANUFACTURER CODE
29	LUBRICATION METHOD:	
30	OIL VISC. ISO GRADE VG	SECONDARY CONTAINMENT (6.7)
31	CONSTANT LEVEL OILER: (9.1.4.2.1)	SECONDARY SEAL:
32	MODEL SPECIFIED:	DESIGN PRESSURE: 59 (-6.0M PaA, same as Primary Casing) barg
33	OILER VENT LOCATION	
34	SUMP COLLECTOR REQUIRED (9.1.4.2.3)	
35	BEARING HOUSING SEAL TYPE (9.1.4.2.7)	
36	SHAFT COUPLING & GUARD: (9.1.5.2)	INSTRUMENTATION (7.4.2) (*4.7) (*4.9)
37	COUPLING MANUFACTURER:	DETECT OPER. OUTSIDE ACCEPT. RANGE OR DECOUPLE [7.4.2.1a]:
38	MODEL SPACER LENGTH mm	REQUIRED METHOD: POWER MONITOR
39	RATING (POWER/100 RPM) SERVICE FACTOR	LOCATION: IN PURCHASER MCC
40	COUPLING BALANCED TO ISO 21940-11 G6.3 (9.1.5.2.3)	IF LOCAL, PROVIDED BY:
41	COUPLING TO ISO 14691 (9.1.5.2.8)	USE FOR: SHUTDOWN (*4.2)
42	COUPLING GUARD STANDARD (9.1.5.2.11.2)	MONITOR LEAKAGE INTO SECONDARY CASING [7.4.2.1b]: YES
43	IGNITION HAZARD ASSESSMENT REQUIRED (9.1.5.2.11.6)	METHOD: (PRESSURE or LEVEL) (*4.4)
44	SPARK-RESISTANT MATERIAL (9.1.5.2.11.7)	SENSOR BY: SUPPLIER
45	BASEPLATE (9.1.5.3) (*4.1)	TYPE: SWITCH
46	BASEPLATE CONSTRUCTION (9.1.5.3.1) FULL TOP DECKING	USE FOR: ALARM (*4.2)
47	BASEPLATE DRAINAGE (9.1.5.3.1.2) DRAIN PAN	
48	MOUNTING: On Embedded Plates (EPs)	MONITOR TEMPERATURE OF [7.4.2.1c]: Returned Circulation Fluid or other (*4.5)
49	NONGROUT CONSTRUCTION: [9.1.5.3.1e] REQUIRED	METHOD: 1 Dual RTD
50	PROVIDE STAINLESS SPACER PLATE UNDER ALL EQUIPMENT	SENSOR BY: SUPPLIER
51	FEET (9.1.5.3.5.3) REQUIRED	TYPE:
52	OTHER Baseplate drain shall be ended with a blind flange.	USE FOR: ALARM & TRIP (*4.2)
53		
54	SEPARATE MOTOR DRIVER (SEE MOTOR DATA SHEET FOR DETAILS)	VIBRATION MONITORING INSTRUMENTS (6.9.8): REQUIRED
55	APPLICABLE SPEC:	METHOD: PERMANENT TRANSDUCER (*4.6)
56	ENCLOSURE	PROVISION REQUIRED: THREADED FOR SENSOR MOUNT
57	INCLUDE: SPACE HEATER VIB. SENSOR	SENSOR BY: SUPPLIER
58	LUBRICATION:	IF FULL TIME, USE FOR: ALARM (*4.2)
59	DRIVE MOTOR BEARING (TYPE/NUMBER):	NUMBER OF CONTINUOUS MONITORING SENSORS: 1 per bearing
60	RADIAL /	
61	THRUST /	
62		

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CANNED MOTOR PUMP DATA SHEET (API 685 3rd)								
1	Note	SURFACE PREPARATION AND PAINT (8.4.5.6)				INSPECTION AND TESTING	Rev	
2		MANUFACTURER'S STANDARD User Specified				GENERAL (8.1)		
3		SPEC. NO. <u>Refer to 9.6.4/9.6.5/9.6.6 of Pump Tech Spec(G2R52F)</u>				DAYS ADVANCED NOTIFICATION OF WITNESSED OR OBSERVED		
4						TESTS AND INSPECTIONS REQUIRED: _____ DAYS		
5		PUMP:				NOTIFICATION OF SUCCESSFUL PRELIMINARY SHOP		
6		PUMP SURFACE PREPARATION _____				PERFORMANCE TEST (8.11.3) REQUIRED		
7		PRIMER _____				SUBMIT INSPECTION CHECKLIST (8.16) REQUIRED		
8		FINISH COAT _____						
9								
10		BASEPLATE:				SHOP INSPECTION (8.2)		
11		BASEPLATE SURFACE PREPARATION _____				ADDNL SUBSURFACE EXAMINATION (6.10.16) (8.2.1.4) YES (*5.1)		
12		PRIMER: _____				PART _____ EXAM _____		
13		FINISH COAT _____				PART _____ EXAM _____		
14						PART _____ EXAM _____		
15		PREPARATION FOR SHIPMENT: (8.4.5)				PART _____ EXAM _____		
16		TYPE OF SHIPMENT: (8.4.3 & 8.4.4) EXPORT				PM TESTING REQUIRED (8.2.3.3) REQUIRED		
17		EXPORT BOXING USER SPEC REQUIRED				PARTS TO BE TESTED <u>For materials with Type 2.2 Certificate as minimum</u>		
18		SPEC. NO. <u>Refer to 13.4 & 13.5 of Pump Tech Spec(G2R52F)</u>				INSPECTION REQUIRED FOR CASTINGS (8.2.2.1)		
19						MAG PARTICLE _____	Refer to Table 9 (Calss III) of API 685 3rd and 11.3 of Pump Tech Spec(G2R52F).	
20		OUTDOOR STORAGE MORE THAN 6 MONTHS YES				RADIOGRAPHY _____		
21						LIQUID PENETRANT _____		
22		DETAILS OF LIFTING DEVICES (8.4.7) _____				ULTRASONIC _____		
23						INSPECTION REQUIRED FOR CONNECTION WELDS (6.10.3)		
24		SPARE PARTS (include cost & details w/ proposal)				MAG PARTICLE _____	Refer to Table 9 (Calss III) of API 685 3rd and 11.3 of Pump Tech Spec(G2R52F).	
25		START-UP _____				LIQUID PENETRANT _____		
26		NORMAL MAINTENANCE _____				RADIOGRAPHY _____		
27		SPARE ASSEMBLY: _____				ULTRASONIC _____		
28		OTHER: _____				CLEANLINESS PRIOR TO FINAL ASSEMBLY (8.2.3.1) WIT		
29		WEIGHTS (kg)				TESTING (8.3)		
30		ITEM No	PUMP	DRIVER	GEAR	BASE	TOTAL	HARDNESS TEST REQUIRED (8.2.3.2) NOT REQUIRED
31								FOR: _____
32								METHOD: _____
33								COMPONENTS TO BE TESTED: _____
34								IMPACT TEST - TO _____
35		OTHER PURCHASER REQUIREMENTS						HYDROSTATIC (8.3.2) WITNESSED
36								WETTING AGENT INCLUDED (8.3.2.7) _____
37		CASTING REPAIR WELD PROCEDURE APPR REQD (6.10.2.5) YES						PERFORMANCE TEST (8.3.3) WITNESSED
38		MAXIMUM DISCHARGE PRESSURE TO INCLUDE (6.2.2):						TEST DATA POINTS- PER 8.3.3.3
39		MAX RELATIVE DENSITY YES						PERFORMANCE CURVE & DATA APPROVAL PRIOR
40		OPERATION TO TRIP SPEED YES						TO SHIPMENT (8.3.3.3.5) REQUIRED
41		MAX DIA. IMPELLERS YES						TEST W/ NPSHA LIMITED TO 110 % SITE NPSHA REQUIRED
42		CONNECTION DESIGN APPROVAL (6.10.3.4.5) YES						RUN UNTIL TEMP STABILIZATION ACHIEVED (9.16.3) N.A.
43		DEMONSTRATE CO- PLANAR MOUNTING PAD SURFACES						4 HR. MECH RUN TEST (8.3.4.2) WITNESSED
44		IN PUMP VENDOR SHOP (9.15.3.4.4) WIT						
45		DYNAMIC BALANCE TO ISO 21940- 11GR. G10 (6.8.6.2) NO						NPSH3 TEST (8.3.4.3) WITNESSED
46								COMPLETE UNIT TEST (8.3.4.4) WITNESSED
47								SOUND LEVEL TEST (8.3.4.5) WITNESSED
48		CONNECTION BOLTING COATING _____						AUXILIARY EQUIPMENT TEST (8.3.4.6) NONE
49		SUBMIT EST. SPL BY OCTAVE BAND (6.120.1) REQUIRED						SECONDARY CONTAIN SYSTEM HYDRO (8.3.4.7) WITNESSED
50		MATERIAL CERTIFICATION REQUIRED (6.10.1.8)						SECONDARY CONTAINMENT/CONTROL SYSTEM INSTRUMENT
51		CASING	YES					TEST (8.3.4.8) WITNESSED
52		IMPELLER	YES					STATIC TORQUE TEST (9.16.1) N.A.
53		SHAFT	YES					RUN UNTIL OIL TEMP STABILIZED (9.16.3) N.A.
54		OTHER	YES	SPECIFY PART				RESIDUAL UNBALANCE TEST (J.4.12) _____
55		VENDOR SUBMIT TEST PROCEDURES (8.3.1.1) REQUIRED						OTHER _____
56		ADDITIONAL DATA REQUIRING 20 YEARS RETENTION (8.2.1.1): _____						
57								
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CANNED MOTOR PUMP DATA SHEET (API 685 3rd)

1	Note	EQUIPMENT CLASSIFICATION										Rev	
2		PIC/ Safety Class (*6.2)	Quality Class	HCC	PED class (*6.1)	ESPN class (*6.1)	Seismic class (*6.10)	Vacuum class	Tritium Class	RH class			
3												3	
4		SIC-1	QC-1	NO	TBD	N2	SC1(S)	N/A	N/A	N/A			
5													
6													
7		REGULATION											
8		MACHINERY - REGULATION (EU) 2023/1230								YES			
9		PRESSURE EQUIPMENT - DIRECTIVE 2014/68/EU								For Auxiliaries only *6.1			
10		ELECTROMAGNETIC COMPATIBILITY - DIRECTIVE 2014/30/EU								YES			
11		LOW VOLTAGE - DIRECTIVE 2014/35/EU								YES			
12		ATEX - DIRECTIVE 2014/34/EU								NO			
13													
14		ENVIRONMENTAL CONDITIONS											
15													
16		Range of Ambient Conditions (*6.3)		Normal Conditions (*6.5)		Degraded Conditions		Storage (*6.5)		Fire (*6.8)			
17	MIN			MAX	Category II.S1(DEC1)	Category III.S1(DEC2)	Indoor	Outdoor	Insulated	non-Insulated			
18		RANGE OF AMBIENT TEMPS [°C]		18	35	5-100	5-130	-8 to 45	-25 to +45	188	400	3	
19		RELATIVE HUMIDITY [%]		0	60	0 to 100		0 to 100					
20		ATMOSPHERIC PRESSURE [kPaA]		95	105	95 to 200		atm		105	105		
21													
22		Room Specific Radiation and Static Magnetic Field		Radiations (*6.4)				Static Magnetic Field Max Modulus [mT] (*6.7)					
23	TID (Total Ionizing Dose) for 20 Years [kGy] (*6.6)			Average TID over 4700 hrs [kGy/hr] (*6.6)	ENF (Equivalent Neutron Fluence) [n/cm2](1MeVeq.)	TNF (Total Neutron flux) [n/cm2/s]							
24		(To silicon) 0.29	(To silicon) 6.2E-05	8.1E+06	26	7.6							
25		(To polymer) 0.28	(To polymer) 5.9E-05										
26		Pumps Area											
27													
28													
29		UTILITIES											
30		Cooling water for Auxiliary heat exchanger and/or jacket cooler (*6.9)											
31		Type : Cooling Water from CCWS-1system (PBS 26)											
32		Unit	Min	Normal	Max	Design	Fluid parameter : Cooling Water from CCWS-1system (PBS 26)						
33		Temperature	°C	Not applicable (*3.4)			Conductivity @ 25 °C	µS/cm	Not applicable (*3.4)				
34		Temperature rise	°C										
35		Pressure	bar g										
36		Pressure drop	bar										
37		Allowable flow	kg/s										
38		Required flow	kg/s										
39		Fouling factor	m2/K/W										
40		(Required flow to be filled by Contractor)											
41													
42													
43													
44													
45													
46													
47		Power rating for electrical equipment											
48		Voltage[V]	Frequency[Hz]	Phase[-]									
49		MV Motor	6600	50	3				For Motor > 200 kw				
50		LV Motor (*3.5)	400	50	3				For Motor ≤ 200kw				
51		Space Heater	230(400)	50	3								
52		Control	24 V DC										
53		Instrumentation	24 V DC										
54		UPS	400(230)	50	3								

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CANNED MOTOR PUMP DATA SHEET (API 685 3rd) - NOTES

1	Note	Rev
2	(*2.1) In addition, refer to annex C of Pump Tech Spec (G2R52F) for full range of operating temperature and pressure, including accidental conditions.	
3	(*2.2) NSPHA - NPSH3 shall not be less than 1 meter at rated point and shall not be negative at the end of curve.	
4	(*2.3) The pump shall be rated based on Mode 2_Baking(Rated), with all of other cases remaining within the allowable operating range of the selected performance curve.	3
5		
6	(*2.4) Maximum suction pressure : 11.34 BarG (Refer to 9.3.2.h of Pump Tech Spec (G2R52F)).	
7	Maximum limit of shut-off head (preliminary) : 462.7 m (when max test tolerance (@ shut-off) is +5%)	
8	(*2.5) Requirement of minimum pump efficiency at the rated point : 32.4% (not mandatory, but preferable)	
9	(*2.6) The pump normally operates alone, but operates in parallel with PL-5701 for a short period during transient operation, as specified in Annex B of 8PZBTB[r6].	
10	Head@130m ³ /h for PL-5701 shall be equal to or higher than Head@34m ³ /h for PL-5703. Head&Flow for parallel run will be adjusted and finalized after purchase order.	
11	(*2.7) Contractor shall add pressure loss of ARC valve to the pump head so that discharge pressure indicated is equal to outlet pressure of ARC valve.	3
12	(*3.1) A horizontal pump with top suction and top discharge nozzles is currently expected for this pump (26CVBD-PL- 5703).	
13	If pump nozzles do not match flange sizes specified, Contractor shall provide nozzle reducers (as per 9.4.3.m and table 10 of Pump Tech Spec (G2R52F)).	
14	(*3.2) Drains shall be collected to single terminal point, including primary casing and secondary casing (as per 9.5.1.k and table 10 of Pump Tech Spec (G2R52F)).	
15	(*3.3) All internal cavities of pump shall be completely self-venting, as vent piping has not been currently planned by IO. When manual venting	
16	or reverse circulation is not avoidable, Contractor shall clearly state it in the Proposal (as per 9.4.3.s of Pump Tech Spec (G2R52F)).	
17	(*3.4) Non-cooling water type is strongly recommended for this pump (26CVBD-PL-5703) (as per 9.5.1.g of Pump Tech Spec (G2R52F)).	
18	(*3.5) This pump (26CVBD-PL-5703) shall be rated as low voltage, assuming that the motor rating is smaller than 200kw (as per 9.7.2.a of Pump Tech Spec (G2R52F)).	
19	(*3.6) Design conditions for process piping. Contractor shall consider this for both suction and discharge regions as dual pressure ratings as minimum.	
20	(*3.7) ARC valve shall be installed directly on pump discharge flange vertically (as per 9.5.8 of Pump Tech Spec (G2R52F)).	3
21	(*4.1) This part (9.15.3) shall be applicable for Canned Motor Pump. The baseplate and anchoring system shall follow 9.5.7 of Pump Tech Spec (G2R52F).	
22	(*4.2) Instrument alarm/trip philosophy shall be recommended by Contractor and mutually agreed with IO, based on their field proven experiences.	
23	(*4.3) Motor winding : 1Dual RTD per phase.	
24	(*4.4) Contractor shall propose an appropriate detection from either pressure sensor (PE) or liquid sensor (LE2) for effective primary leakage monitoring.	
25	(*4.5) Contractor shall propose an appropriate location of temperature monitoring among stator liner, containment shell and returned circulation fluid,	
26	in terms of effective primary leakage monitoring (and potential bearing condition monitoring).	
27	(*4.6) Vibration sensors shall be radiation resistant piezoelectric accelerometer (as per 5.2.16 of Y6R3VX [d65]).	
28	(*4.7) The following instrument shall be provided for monitoring proper pump operation for each pump.	
29	- An instrument (portable & use for commissioning only) that indicates that the rotor is rotating in the correct direction (9.2.2.13 of API 685 3rd).	
30	- Bearing wear detector or shaft position sensor, monitoring bearing conditions remotely with alarm function (9.2.5 of API 685 3rd).	
31	(*4.8) If the motor design shall be modified from conventional design to meet the environmental conditions (including radiations, static magnetic field	
32	and fire case, see details in sheet 7) such as filling a liquid or solid material in the stator cavity or using a special type of motor winding,	
33	Contractor shall state the modification plan together with technical justification in their proposal and agree with IO before Purchase order.	
34	(*4.9) Unless otherwise permanent signal converter (containing semiconductor such as transducer, transmitter) for any instrument is qualified for the	
35	environmental conditions including radiation and neutron, they shall be installed in the safe area (inside Remote IO cabinet supplied by IO) and supplied as loose.	
36	For vibration sensors, output signal from the permanent signal converter shall be 4-20mA.	
37		
38	(*5.1) The secondary pressure casing shall be inspected to the same inspection class as primary casing (=Class III in Table 9 of API 685 3rd).	
39		
40	(*6.1) Contractor shall present a request of exclusion for PED&ESPN to be applied to pump pressure boundary. PED&ESPN class will be applied case by case depending	
41	the auxiliary component. N2 ESPN class is the classification of piping connected to inlet and discharge nozzle, while ARC valve is classified as N3 ESPN.	3
42	(*6.2) SIC- 1 For Confinement Only.	
43	(*6.3) Source of references: Appendix C of Pump Tech Spec (G2R52F), TCWS CVBD Process Loading Condition (8PZBTB[r6])	
44	(*6.4) Source of references: Radiation environment for equipment during operations (3FM52L[d11])	
45	(*6.5) Contractor shall consider outdoor storage before installation and indoor storage during installation. Normal condition to be also applied to	
46	activities and storage time after installation during commissioning.	
47	(*6.6) TID (Total Ionizing Dose) are referred to silicon and polymer dose. Installation life is 20 years, but total irradiation time is 4700 h.	
48	Irradiation by ENF (Equivalent Neutron Fluence) and TNF (Total Neutron flux) shall be considered for Electronic Devices.	
49	(*6.7) Qualification testing shall to be performed with a field strength that is 1.4 times these current field values.	
50	Values of static magnetic field Modulus have been calculated using Tool in reference of 53KMVD[r14].	
51	For detailed composition of magnetic field, refer to maps (Level L4 tokamak complex) in references QUDEGC[r21].	
52	(*6.8) These fire temperatures shall be considered as a static condition for the Main pumps (pumps not running).	
53	These two temperature values are referred to the maximum temperature under fire insulation (insulated) and maximum	
54	temperature of surfaces not covered by fire insulation (non-insulated).	
55	(*6.9) Deleted	
56	(*6.10) Pump shall be SC1(S), while ARC valve (with BP valve) shall be SC1(SF) to maintain check valve functionality during an earthquake.	3
57		

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Appendix B – Nozzle Loads

- a. The required nozzle loads for pump package provided in this appendix are derived from [r3].
- b. These nozzle loads are considered at the pump flanges N1 (Suction), N2 (Discharge(=Outlet of ARC valve)) and N3(Bypass of ARC Valve). These loads are calculated considering piping designed as per applicable piping class up to the scope boundary of pump package.
- c. The nozzle coordinate system for forces and moments is provided in API 685 3rd, Figure 4.
- d. Pump shall be designed as a minimum for the nozzle loads given in Table 15. The nozzle load for N2 shall be applicable for outlet of ARC valve, not for outlet of pump casing.
- e. Deleted
- f. The allowable nozzle loads for both “Pump without ARC Valve” and “Pump with ARC valve (&BP Valve)” shall be supplied by Contractor during the design phase and shall envelop the values given in this Appendix.
- g. External loads on Auxiliaries Nozzles will be shared by IO in the detailed engineering phase.
- h. Water hammer cases have been developed using methodology included in [r7].
- i. Deleted
- j. In case that external piping load exceeds allowable nozzle loads specified in Table 15 below, Contractor shall perform FEM (Finite Element Method) analysis to evaluate its impact and shall reinforce their pump design as necessary at no extra cost to IO.

Table 15 - Minimum Required Nozzle Loads

Minimum Required Nozzle Loads			
Nozzle	DN [mm]	Service Level	Ratio to API 685 3rd, Table 4A
For 26CVBD-PL-5701 (CVBD Charging Pump 1)			
N1 (Suction)	150	A/B	3.0
		C/D(without fire)	4.5
		C/D(with fire)	6.0
N2 (Discharge (=Outlet of ARC Valve))	150	A/B	3.0
		C/D(without fire)	4.5
		C/D(with fire)	6.0
N3 (Bypass of ARC Valve))	150	A/B	3.0
		C/D(without fire)	4.5
		C/D(with fire)	6.0
For 26CVBD-PL-5703 (CVBD Charging Pump 2)			
N1 (Suction)	80	A/B	3.0
		C/D(without fire)	4.5
		C/D(with fire)	6.0
N2 (Discharge (=Outlet of ARC Valve))	80	A/B	3.0
		C/D(without fire)	4.5
		C/D(with fire)	6.0
N3 (Bypass of ARC Valve))	40	A/B	3.0
		C/D(without fire)	4.5
		C/D(with fire)	6.0

Table 16 - Deleted

Pump	Nozzle	FX	FY	FZ	FR	MX	MY	MZ	MR
Deleted									

SUPPLY

Appendix C – Process Loading Conditions

- a. The ITER loading conditions are categorized, into four classes based on the expectation of occurrence (ref. [r4] and [d6]):
 - i. Category I: Operational Loading Conditions
 - ii. Category II: Likely Loading Conditions
 - iii. Category III: Unlikely Loading Conditions
 - iv. Category IV: Extremely Unlikely Loading Conditions
- b. Service Level Definition [r5]:
 - A: Normal Operation. All structures, systems, and components are functional.
 - B: Same service level as for Criteria Level A but with lower margin.
 - C: May be significant local distortion. May need to inspect, call for repair or replacement of faulty components.
 - D: May be large general distortion and investment loss. Repair may not be considered economic. Safety functions shall be maintained.
- c. The relation between load conditions and service levels is established in ref.[r6]. The specific loading conditions related to Pump are given in the table here below. Contractor shall refer to [Table 17] in conjunction with ref.[r6].
- d. Allowable values and limits in service level C and D for ITER mechanical components are fixed in [d6].
- e. Water hammer cases have been developed using methodology included in [r7]. Loading conditions included with strikethrough font in [Table 17] are not applicable to Pump.

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Table 17 - Process Load Conditions for Pump

Service Level	L/C No.	Loading Conditions	Cycles	PT4 = VCT CVBD Charging Pumps Suction P [MPaA] T [°C]	PT5 = Charging pump discharge CVBD Charging Pumps Discharge P [MPaA] T [°C]	Comment	Status of PL-5701 (running/stopped/ pump trips)	Status of PL-5703 (running/stopped/ pump trips)
A	I.S0	Design Conditions	-	1.2 MPa 100 °C	6.0 MPa 100 °C		running	running
A	I.S1	Standby Mode (Low flow)	-	See I.S6	See I.S6		running	stopped
A	I.S2	Water Baking Operation at 240 °C	-	0.6 MPa 50 °C	4.6 MPa 50 °C		running	running
A	I.S3	Idle Mode	-	0.15 MPa Tccws	2.0 MPa Tccws		running	stopped
A	I.S4	Off Mode	-	0.3 MPa Tamb	0.3 MPa Tamb		stopped	stopped
A	I.S5	Maintenance Mode	-	0.1 MPa Tamb	0.1 MPa Tamb		stopped	stopped
A	I.S6	Standby Mode (Nominal Flow)	-	0.6 MPa 50 °C	4.8 MPa 50 °C		running	stopped
A	I.S7	Gas Baking Operation at 390 °C	-	N/A	N/A	-	-	-
A	I.S8	Water Baking Operation at 18 °C	-	0.6 MPa 18 deg. C	4.6 MPa 18 deg. C		running	running
A	I.S9	First Plasma Gas Baking Operation at 240 °C	-	N/A	N/A	-	-	-
A	I.T1	Plasma Operation	30000	0.6 MPa 50 °C	2.2 MPa 50 °C		running	stopped
A	I.T2	Standby Mode (Low Flow) to Water Baking Operation	500	[0.19,1.25] MPa 50 deg. C	[0.1,4.6] MPa 50 deg. C	At the beginning only PL-5701 is running and then after a certain point also PL-5703	running	running

SUPPLY

Service Level	L/C No.	Loading Conditions	Cycles	PT4 = VCT CVBD Charging Pumps Suction P [MPaA] T [°C]	PT5 = Charging pump discharge CVBD Charging Pumps Discharge P [MPaA] T [°C]	Comment	Status of PL-5701 (running/stopped/ pump trips)	Status of PL-5703 (running/stopped/ pump trips)
A	I.T14	Idle Mode to Water Baking Operation		[0.1,0.6] MPa [10, 50] deg. C	[0.1,4.6] MPa [10, 50] deg. C		running	running
A	I.T3	Water Baking Operation to Standby Mode (Low Flow)	500	[0.19,1.25] MPa 50 deg. C	[0.1,4.6] MPa 50 deg. C	At the beginning both pumps are running then PL-5703 will stop	running	running
A	I.T15	Water Baking Operation to Idle Mode		[0.1,0.6] MPa [10, 50] deg. C	[0.1,4.6] MPa [10, 50] deg. C	At the beginning both pumps are running then PL-5703 will stop	running	running
A	I.T4	Standby Mode (Low Flow) to Idle Mode	500	[0.15,0.6] MPa [10, 50] deg. C	[0.1,2.2] MPa [10, 50] deg. C		running	stopped
A	I.T5	Idle Mode to Standby Mode (Low Flow)	500				running	stopped
A	I.T6	Off Mode to Maintenance Mode	500	[0.1, 0.6] MPa	[0.1, 0.6] MPa		stopped	stopped
A	I.T7	Maintenance Mode to Off Mode	500	Tamb	Tamb		stopped	stopped
A	I.T8	Off Mode to Idle Mode	500	[0.1,0.15] MPa	[0.1,1.9] MPa		running	stopped
A	I.T9	Idle Mode to Off Mode	500	[10, 35] deg. C	[10, 50] deg. C		running	stopped
A	I.T10	Clients Dryout during Maintenance Mode	50	0.1 MPa Tamb	[0.1, 3.3] MPa [40, 240] °C	CVBD will be isolated	N/A	N/A

SUPPLY

Service Level	L/C No.	Loading Conditions	Cycles	PT4 = VCT CVBD Charging Pumps Suction P [MPaA] T [°C]	PT5 = Charging pump discharge CVBD Charging Pumps Discharge P [MPaA] T [°C]	Comment	Status of PL-5701 (running/stopped/ pump trips)	Status of PL-5703 (running/stopped/ pump trips)
A	I.T11	Clients Blowout during Maintenance Mode	See comment	0.1 MPa Tamb	[3.0, 3.9] MPa [30, 40] °C	These 50 cycles are decomposed in 900 sub-cycles for PT5 (18groups of 3 x divertor cassettes), 1800 sub-cycles for PT6 (36 x half a FW/BLK sector), & 1200 sub-cycles for PT7 (24 EQ port clients).	N/A	N/A
A	I.T12	Maintenance Mode to Gas Baking Operation	15	0.1 MPa [10, 35] °C	[0.1, 3.0] MPa [40, 390] °C	CVBD will be isolated	N/A	N/A
A	I.T13	Gas Baking Operation to Maintenance Mode	15				N/A	N/A
A	I.T16	Standby Mode (Low Flow) to Standby Mode (Nominal Flow)	4000	0.6 MPa 50 deg. C	[2.2, 4.6] MPa 70 °C		running	stopped
A	I.T17	Standby Mode (Nom. Flow) to Standby Mode (Low Flow)	4000				running	stopped
A	I.T18	MD Category I	2600	N/A		This loading condition is only applicable to IBED PHTS divertor piping inside cryostat.	N/A	N/A
A	I.T19	Maintenance Mode to First Plasma Gas Baking Operation	18	0.1 MPa Tamb	[0.1, 3.2] MPa [18, 240] °C		N/A	N/A
A	T.T20	First Plasma Gas Baking Operation to Maintenance Mode	18				N/A	N/A

SUPPLY

Service Level	L/C No.	Loading Conditions	Cycles	PT4 = VCT CVBD Charging Pumps Suction P [MPaA] T [°C]	PT5 = Charging pump discharge CVBD Charging Pumps Discharge P [MPaA] T [°C]	Comment	Status of PL-5701 (running/stopped/ pump trips)	Status of PL-5703 (running/stopped/ pump trips)
A	II.S1	DEG1 Degraded Environmental Conditions	-	Environmental pressure: [95, 200] kPa Environmental temperature: [5, 100] °C Environmental air humidity: [0, 100] %			running	running
A	II.T1	Short-Term LOOP	50	[0.2, 1.2] MPa [10, 90] deg. C	[4.3, 5.0] MPa [10, 114] deg. C		pump trips	pump trips
A	II.T2	Cat. II Break within In-Vessel LOCA Boundaries	50	[0.6, 0.77] MPa 18 deg. C	[0.0, 5.0] MPa 18 °C	In case of category II pipe break, significant hydraulic loads may be generated outside of the in-vessel LOCA boundaries of the affected client. The in-vessel LOCA boundaries of the affected client consist of 2 redundant inlet in-vessel LOCA isolation valves and 2 redundant outlet in-vessel LOCA check-valves. In-vessel LOCA isolation valves and in-vessel LOCA check-valves must be able to close. Additional data required for sizing must be specified by valve supplier and provided by IO TCWS.	running	running
A	II.T4	Loss of HVAC Incident	50	[-0.2] MPa [18, 100] °C	[-0.2] MPa [18, 100] °C		stopped	stopped
A	II.T5	SL-1 Seismic Event	50	0.6 MPa 50 deg. C	4.6 MPa 240 °C	SL-1 is cumulated to this bounding case. If needed, it is possible to use 2 couples of highest operational conditions for PT5: (3.2 MPa, 390 °C) and (4.6 MPa, 240 °C).	running	running

SUPPLY

Service Level	L/C No.	Loading Conditions	Cycles	PT4 = VCT CVBD Charging Pumps Suction P [MPaA] T [°C]	PT5 = Charging pump discharge CVBD Charging Pumps Discharge P [MPaA] T [°C]	Comment	Status of PL-5701 (running/stopped/ pump trips)	Status of PL-5703 (running/stopped/ pump trips)
A	N.A	Combination I.T18 + II.T5 = SL 1 + MD 1	-	I.T1 → I.T1 + MD 1 + SL 1 → I.T1		This loading condition is only applicable to IBED PHTS divertor piping inside cryostat.	-	-
A	II.T6	WH Pump start up (Cat II)	60	refer to ch 8.7			pump trips	pump trips
A	II.T7	CrICE Category II	15	During plasma: I.T1 → I.T1 + CrICE II → I.T1 With guard external pressure from 1E-7 to 30 kPa in 1 ms and guard temperature from 66 to -54 °C in 1 s During water baking: I.S8 → I.S8 + CrICE II → I.S8 With guard external pressure from 1E-7 to 30 kPa in 1 ms and guard temperature from 221 to -28 °C in 1 s		This loading condition is only applicable to IBED PHTS piping inside cryostat.	-	-
A	II.T8	VDE Category II	300	I.T1 → I.T1 + VDE II → I.T1		This loading condition is only applicable to IBED PHTS piping inside cryostat.	-	-

SUPPLY

Service Level	L/C No.	Loading Conditions	Cycles	PT4 = VCT	PT5 = Charging pump discharge	Comment	Status of PL-5701 (running/stopped/ pump trips)	Status of PL-5703 (running/stopped/ pump trips)
				CVBD Charging Pumps Suction P [MPaA] T [°C]	CVBD Charging Pumps Discharge P [MPaA] T [°C]			
A	II.T9	WH Spurious LOCA Isolation Valve Closure	5	For in-vessel LOCA valves: During plasma: I.T1 + simultaneous closure of in-vessel LOCA isolation valves (Impulse case 1b from TYHFX v2.1) During baking: I.S2 + simultaneous closure of in-vessel LOCA isolation valves (Impulse case 5 from TYHFX v2.1) For ex-vessel LOCA valves: During plasma: I.T1 + simultaneous closure of ex-vessel LOCA isolation valves (Impulse case 2 from TYHFX v2.1) During baking: I.S2 + simultaneous closure of ex-vessel LOCA isolation valves (Impulse case 6 from TYHFX v2.1)			running	running
A	II.WH	Bounding Case for Category II Water Hammer Events (II.T6 & II.T9)	65	0.05 MPa Tccws	[2.2, 6.0] MPa 100 °C	100% design pressure is never exceeded for category II water hammer events (II.T6 & II.T9). Their initial operating conditions are based on I.S2 & I.T1. A bounding case is thus defined based on sudden pressure variation from lowest operating pressure to design pressure at constant highest operational temperature, and vice versa.	N/A	N/A

SUPPLY

Service Level	L/C No.	Loading Conditions	Cycles	PT4 = VCT CVBD Charging Pumps Suction P [MPaA] T [°C]	PT5 = Charging pump discharge CVBD Charging Pumps Discharge P [MPaA] T [°C]	Comment	Status of PL-5701 (running/stopped/ pump trips)	Status of PL-5703 (running/stopped/ pump trips)
A	II.T11	OPP Category II	50	[0.2, 1.2] MPa 100 °C	[2.2, 6.0] MPa 100 °C	pump trip will occur before reaching max pressure in the suction	running	running
A	II.T12	HX Tube Leakage	1	[0.1, 1.2] MPa [50, 100] °C	4.6 MPa [50, 100] °C		running	running
C	III.S1	DEG2 Highly Degraded Environmental Conditions	-	Environmental pressure: [95, 200] kPa Environmental temperature: [5, 130] °C Environmental air humidity: [0, 100] %			running	running
C	III.T1	Long-Term LOOP	1	0.1 → 1.2 → 0.1 MPa 10 → 190 → 10 °C	4.6 → 5.0 → 4.6 MPa 70 → 190 → 10 → 70 °C		stopped	stopped
C	III.T2	Short-Term LOOP + Loss of HVAC Incident	1	II.T1 → II.T1 + II.S1 → II.T1		This loading condition is covered by the bounding case suggested for loss of HVAC incident (II.T4), and the bounding case for short-term LOOP (II.T1).	N/A	N/A
C	III.T3	LOCA Outside Cryostat	1	[-0.2] MPa 18 → 130 → 18 °C	[-0.2] MPa 18 → 130 → 18 °C		stopped	stopped
C	III.T4	WH Pump Seizure	1	Baking pump: I.S2 + 1 ms PL-1900 seizure (Impulse case 10 from TYHFX v2.1)			pump trips	pump trips
C	III.T5	SMHV Seismic Event	1	0.6 MPa 50 deg. C	4.6 MPa 240 °C	SMHV is cumulated to this bounding case.	running	running

SUPPLY

Service Level	L/C No.	Loading Conditions	Cycles	PT4 = VCT CVBD Charging Pumps Suction P [MPaA] T [°C]	PT5 = Charging pump discharge CVBD Charging Pumps Discharge P [MPaA] T [°C]	Comment	Status of PL-5701 (running/stopped/ pump trips)	Status of PL-5703 (running/stopped/ pump trips)
C	III.T6	CrICE Category III	±	During plasma: I.T1 → I.T1 + CrICE III → I.T1 With guard external pressure from 1E-7 to 140 kPa in 1 ms and guard temperature from 66 to 63 °C in 1 s During water baking: I.S8 → I.S8 + CrICE III → I.S8 With guard external pressure from 1E-7 to 140 kPa in 1 ms and guard temperature from 221 to 48 °C in 1 s		This loading condition is only applicable to IBED PHTS piping inside cryostat.	-	-
C	III.T7	VDE Category III	±	I.T1 → I.T1 + VDE III → I.T1		This loading condition is only applicable to IBED PHTS piping inside cryostat.	-	-
C	III.T8	Helium Leak in CSR	±	This loading condition is not considered for IBED PHTS guard pipes in CSR as they are insulated with 50 mm of Microtherm or equivalent. But it must be considered for supports (if any). See SZE5MR v2.6 Section 10.5 for further details.		This loading condition is only applicable to IBED PHTS supports in CSR (= interspace between cryostat and bioshield).	-	-

SUPPLY

Service Level	L/C No.	Loading Conditions	Cycles	PT4 = VCT CVBD Charging Pumps Suction P [MPaA] T [°C]	PT5 = Charging pump discharge CVBD Charging Pumps Discharge P [MPaA] T [°C]	Comment	Status of PL-5701 (running/stopped/ pump trips)	Status of PL-5703 (running/stopped/ pump trips)
C	III.T9	WH Break Propagation	1	Pipe break upstream VK-0183 (divertor loop): I.S8 + Pipe break upstream VK-0183 (Impulse case 7 from TYHFX v2.1) Pipe break upstream VK-0477 (EQ port loop): I.S8 + Pipe break upstream VK-0477 (Impulse case 8 from TYHFX v2.1) Pipe break upstream VK-0253 (FW/BLK loop): I.S8 + Pipe break upstream VK-0253 (Impulse case 9 from TYHFX v2.1) Baking supply header break: I.S8 + Baking supply header break (Impulse case 15 from TYHFX v2.1) Baking pump discharge break: I.S8 + Baking pump discharge break (Impulse case 17 from X9AZZL v5.1) Linear return header break: I.T1 + Linear return header break (Impulse case 16 from TYHFX v2.1 & Impulse case 10 from X9AZZL v5.1) Linear supply header break: I.T1 + Linear supply header break (Impulse case 11 from X9AZZL v5.1) FW/BLK loop main supply break: I.T1 + FW/BLK loop main supply break (Impulse case 17 from TYHFX v2.1) Primary pump discharge break: I.T1 + Primary pump discharge break (Impulse case 9 from X9AZZL v5.1)		These pipe breaks should not result in damaging: * piping inside cryostat. * piping across any ex-vessel LOCA isolation valve.	N/A	N/A
C	III.T10	OPP Category III	1	0.1 → 1.32 MPa 100 °C	0.1 → 6.6 MPa 100 °C	pump trip will occur before reaching max pressure in the suction	running	running

SUPPLY

Service Level	L/C No.	Loading Conditions	Cycles	PT4 = VCT CVBD Charging Pumps Suction P [MPaA] T [°C]	PT5 = Charging pump discharge CVBD Charging Pumps Discharge P [MPaA] T [°C]	Comment	Status of PL-5701 (running/stopped/pump trips)	Status of PL-5703 (running/stopped/pump trips)
C	III.T11	WH Spurious & Simultaneous LOCA Isolation Valves Closure with a Single Failure	1	I.T1 + simultaneous closure of all LOCA isolation valves except one (Impulse case 1a from X9AZZL v5.1)			N/A	N/A
C	III.WH	Bounding Case for Category III Water Hammer Events (III.T4 & III.T11)	1	0.1 MPa Tccws	2.2 → 6.6 → 2.2 MPa 100 °C	110% design pressure is never exceeded for category III water hammer events (III.T4 & III.T11). Their initial operating conditions are based on I.S2 & I.T1. A bounding case is thus defined based on sudden pressure variation from lowest operating pressure to design pressure at constant highest operational temperature, and vice-versa.	running	running
C	III.T12	Cat. III Pipe Break within In-Vessel LOCA Boundaries	1	0.1 MPa Tccws	4.6 → 0.0 MPa 4.6 → 5.5 → 4.6 MPa 18 °C	In case of category III pipe break, significant hydraulic loads may be generated outside of the in-vessel LOCA boundaries of the affected client. The in-vessel LOCA boundaries of the affected client consist of 2 redundant inlet in-vessel LOCA isolation valves and 2 redundant outlet in-vessel LOCA check-valves. In-vessel LOCA isolation valves and in-vessel LOCA check-valves must be able to close. Additional data required for sizing must be specified by valve supplier and provided by IO TCWS.	N/A	N/A

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Service Level	L/C No.	Loading Conditions	Cycles	PT4 = VCT CVBD Charging Pumps Suction P [MPaA] T [°C]	PT5 = Charging pump discharge CVBD Charging Pumps Discharge P [MPaA] T [°C]	Comment	Status of PL-5701 (running/stopped/ pump trips)	Status of PL-5703 (running/stopped/ pump trips)
C	III.T13	Helium Leak in Galleries	±	This loading condition is not considered for IBED PHTS guard pipes (for primary side) and process pipes (for secondary side) in galleries as they are insulated with 50 mm of Microtherm or equivalent. But it must be considered for supports (if any). See SZE5MR v2.6 Section 10.5 for further details.		This loading condition is only applicable to IBED PHTS supports in galleries.	-	-
C	N.A	Combination II.T5 + II.T8 = SL 1 + VDE Category II	±	I.T1 → I.T1 + SL 1 + VDE II → I.T1		This loading condition is only applicable to IBED PHTS piping inside cryostat.	-	-
C	N.A	Combination III.T5 + III.T6 = SMHV + CrICE Category III	±	During plasma: I.T1 → I.T1 + SMHV + CrICE III → I.T1 With guard external pressure from 1E-7 to 140 kPa in 1 ms and guard temperature from 66 to 63 °C in 1 s During water baking: I.S8 → I.S8 + SMHV + CrICE III → I.S8 With guard external pressure from 1E-7 to 140 kPa in 1 ms and guard temperature from 221 to 48 °C in 1 s		This loading condition is only applicable to IBED PHTS piping inside cryostat.	-	-

SUPPLY

Service Level	L/C No.	Loading Conditions	Cycles	PT4 = VCT CVBD Charging Pumps Suction P [MPaA] T [°C]	PT5 = Charging pump discharge CVBD Charging Pumps Discharge P [MPaA] T [°C]	Comment	Status of PL-5701 (running/stopped/ pump trips)	Status of PL-5703 (running/stopped/ pump trips)
C	N.A	Combination III.T5 + III.T8 / III.T13 = SMHV + Helium Leak in CSR or Galleries	1	During plasma: I.T1 → I.T1 + SMHV + Helium Leak in CSR → I.T1 During water baking: I.S2 → I.S2 + SMHV + Helium Leak in CSR → I.S2 During plasma: I.T1 → I.T1 + SMHV + Helium Leak in Galleries → I.T1 During water baking: I.S2 → I.S2 + SMHV + Helium Leak in Galleries → I.S2		This loading condition is only applicable to IBED PHTS supports in CSR and in galleries.	-	-
C	N.A	Combination III.WH + III.T5 = SMHV + WH Cat. II or III	1	0.1 MPa Tccws	4.6 → 5.5 → 4.6 MPa 240 °C	SMHV is cumulated to bounding case III.WH. Note that this covers any combination of category II / III water hammer events with SMHV.	N/A	N/A
D	IV.S1	Fire Design Basis	1	The fire design basis event is based on Eurocode 1 EN 1991-1-2:2002. Environmental temperature increases up to 1049 °C for a fire duration of 2 hr. IBED PHTS fire insulation is sized to ensure that the maximum process temperature in case of fire never exceeds the saturation temperature at design pressure.			stopped	stopped
D	IV.T1	Fire Exposure	1	0.1 → 1.32 → 0.1 MPa	0.6 → 5.5 → 0.6 MPa 18 → 263 → 18 °C		stopped	stopped

SUPPLY

Service Level	L/C No.	Loading Conditions	Cycles	PT4 = VCT CVBD Charging Pumps Suction P [MPaA] T [°C]	PT5 = Charging pump discharge CVBD Charging Pumps Discharge P [MPaA] T [°C]	Comment	Status of PL-5701 (running/stopped/ pump trips)	Status of PL-5703 (running/stopped/ pump trips)
D				18 → 188 → 18 °C				
	IV.T2	SL-2 Seismic Event	1	0.6 MPa 50 deg. C	4.6 MPa 240 °C	SL-2 is cumulated to this bounding case.	running	running
D	IV.T3	CrICE Category IV	±	During plasma: I.T1 → I.T1 + CrICE IV → I.T1 With guard external pressure from 1E-7 to 200 kPa in 1 ms and guard temperature from 66 to 64 °C in 1 s During water baking: I.S8 → I.S8 + CrICE IV → I.S8 With guard external pressure from 1E-7 to 200 kPa in 1 ms and guard temperature from 221 to 51 °C in 1 s		This loading condition is only applicable to IBED PHTS piping inside cryostat.	-	-
D	IV.T4	VDE Category IV	±	I.T1 → I.T1 + VDE IV → I.T1		This loading condition is only applicable to IBED PHTS piping inside cryostat.	-	-

SUPPLY

Service Level	L/C No.	Loading Conditions	Cycles	PT4 = VCT CVBD Charging Pumps Suction P [MPaA] T [°C]	PT5 = Charging pump discharge CVBD Charging Pumps Discharge P [MPaA] T [°C]	Comment	Status of PL-5701 (running/stopped/ pump trips)	Status of PL-5703 (running/stopped/ pump trips)
D	IV.T5	Cat. IV Pipe Break within In-Vessel LOCA Boundaries	1	0.1 MPa Tccws	4.6 → 0.0 MPa 4.6 → 6.0 → 4.6 MPa 18 °C	In case of category IV pipe break, significant hydraulic loads may be generated outside of the in-vessel LOCA boundaries of the affected client. The in-vessel LOCA boundaries of the affected client consist of 2 redundant inlet in-vessel LOCA isolation valves and 2 redundant outlet in-vessel LOCA check-valves. In-vessel LOCA isolation valves and in-vessel LOCA check-valves must be able to close. Additional data required for sizing must be specified by valve supplier and provided by IO TCWS.	running	running
D	IV.T6	WH Severe Pump Seizure	1	refer to ch 10.7			stopped	stopped
D	IV.WH	Bounding Case for WH Severe Pump Trip	1	refer to ch 10.8			pump trips	pump trips

SUPPLY

Service Level	L/C No.	Loading Conditions	Cycles	PT4 = VCT CVBD Charging Pumps Suction P [MPaA] T [°C]	PT5 = Charging pump discharge CVBD Charging Pumps Discharge P [MPaA] T [°C]	Comment	Status of PL-5701 (running/stopped/ pump trips)	Status of PL-5703 (running/stopped/ pump trips)
D	N.A	Combination IV.T3 + IV.T2 = SL 2 + CrICE Category IV	±	During plasma: I.T1 → I.T1 + SL 2 + CrICE IV → I.T1 With guard external pressure from 1E-7 to 200 kPa in 1 ms and guard temperature from 66 to 64 °C in 1 s During water baking: I.S8 → I.S8 + SL 2 + CrICE IV → I.S8 With guard external pressure from 1E-7 to 200 kPa in 1 ms and guard temperature from 221 to 51 °C in 1 s		This loading condition is only applicable to IBED PHTS piping inside cryostat.	-	-
D	N.A	Combination IV.T2 + III.T8 / III.T13 = SL 2 + Helium Leak in CSR or Galleries	±	During plasma: I.T1 → I.T1 + SL 2 + Helium Leak in CSR → I.T1 During water baking: I.S2 → I.S2 + SL 2 + Helium Leak in CSR → I.S2 During plasma: I.T1 → I.T1 + SL 2 + Helium Leak in Galleries → I.T1 During water baking: I.S2 → I.S2 + SL 2 + Helium Leak in Galleries → I.S2		This loading condition is only applicable to IBED PHTS supports in CSR and in galleries.	-	-

SUPPLY

Service Level	L/C No.	Loading Conditions	Cycles	PT4 = VCT CVBD Charging Pumps Suction P [MPaA] T [°C]	PT5 = Charging pump discharge CVBD Charging Pumps Discharge P [MPaA] T [°C]	Comment	Status of PL-5701 (running/stopped/ pump trips)	Status of PL-5703 (running/stopped/ pump trips)
D	N.A	Combination IV.WH + IV.T2 = SL-2 + WH Cat. II, III, or IV	1	0.1 MPa Tccws	4.6 → 6.0 → 4.6 MPa 240 °C	SL-2 is cumulated to bounding case IV.WH. Note that this covers any combination of category II / III / IV water hammer events with SL-2.	N/A	N/A
A	U.S1	Storage Env. Conditions	-	OUTDOORS Environmental pressure: atmospheric Environmental temperature: [-25, 45] °C Environmental air humidity: 30 g/kg (=> 100% at 32 °C and 50% at 45 °C) Extreme winds up to 166 km/hr Maximum mass of snow: 150 daN/m2 INDOORS Environmental pressure: atmospheric Environmental temperature: [-8, 45] °C Environmental air humidity: 30 g/kg (=> 100% at 32 °C and 50% at 45 °C)			stopped	stopped
A	U.T1	Hydrostatic Pressure Test	10	0.1 → 1.9 → 0.1 MPa [5, 45] °C	0.1 → 9.4 → 0.1 MPa [5, 45] °C		stopped	stopped

SUPPLY

Service Level	L/C No.	Loading Conditions	Cycles	PT4 = VCT	PT5 = Charging pump discharge	Comment	Status of PL-5701 (running/stopped/ pump trips)	Status of PL-5703 (running/stopped/ pump trips)
				CVBD Charging Pumps Suction P [MPaA] T [°C]	CVBD Charging Pumps Discharge P [MPaA] T [°C]			
A	U.T2	Containment Leak-Tightness Test	10	Environmental pressure: [95, 200] kPa Environmental temperature: [18, 35] °C Environmental air humidity: [0, 60] %			stopped	stopped

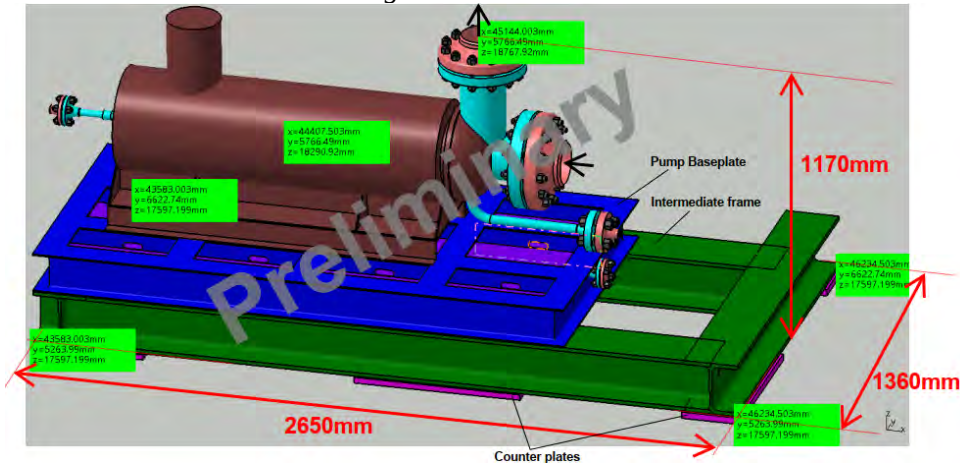
SUPPLY

Appendix D – Installation Data and Drawings

Installation Data						
	Installation Area	Length [mm]	Width [mm]	Height [mm]	Weight [kg]	Pump outline
26CVBD-PL-5701	Building 14 Level 4 Zone 21	(2650)	(1360)	(1170 without ARC valve)	7500	Figure D.1
26CVBD-PL-5703	Building 14 Level 4 Zone 21	(2560)	(1300)	(1170 without ARC valve)	7500	Figure D.2

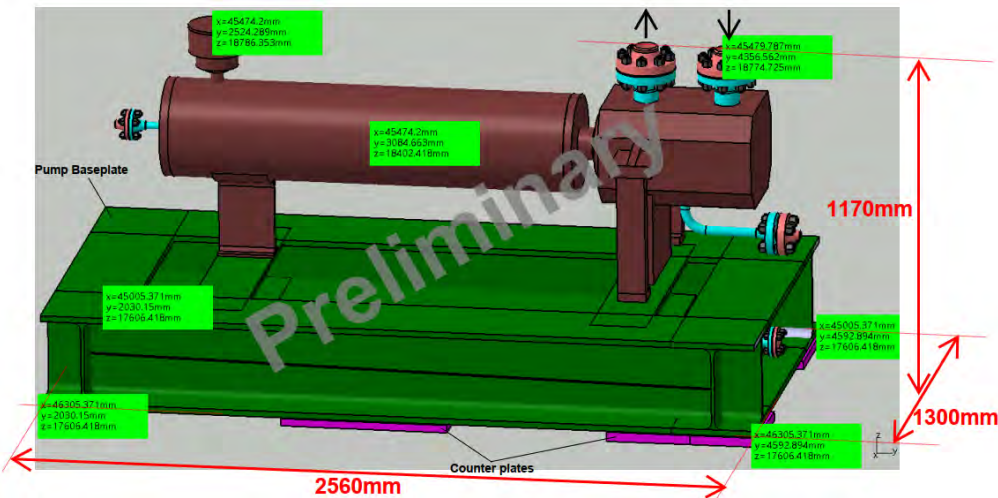
Length, width and height in the table above and pump outlines in figure D.1&D.2 are preliminary and shown for reference only (ARC valves are not shown yet). For detailed and final requirements that Contractor shall strictly follow, including as built data of Embedded plates, refer to [d78] and [d89]. Suction and discharge flanges positions given in [d78] and [d89] shall be respected as much as reasonably possible. A height of casing drain connection shall not be lower than dimensions specified to have a proper slop of piping at IO side.

Figure D.1 : PL-5701



(Note: For the baseplate of PL-5701, Contractor can decide to adopt two pieces of baseplate (pump baseplate + intermediate frame as shown in Figure D.1) or one thick baseplate only.)

Figure D.2 : PL-5703



SUPPLY

Appendix E – Seismic Loads

The seismic events applicable to be considered in this scope of supply ITER plant are (see reference [d62]):

a. SL-2 earthquake

Design Response Spectra (DRS) which is defined by two spectra: SMS and PALEO spectra. Earthquake producing maximal vibratory ground movement, during which certain systems, structures and components are designed to remain functional. This is referred to in IEC/IEEE 60980-344 [s46] as Safe Shutdown Earthquake (SSE) or S2 Level.

According to IAEA recommendations, for Safety Importance Class (SIC) components and nuclear buildings (SC-1 or SC-2), the SL-2 seismic load is referred to a return period of about 10000 years (for Paleo earthquake) and the associated earthquake is classified as an “extremely unlikely” event.

b. SMHV earthquake

Séismes Maximaux Historiquement Vraisemblables (Maximum Historically Probable Earthquakes) is the most penalizing earthquakes liable to occur over a period of about 1000 years.

The SMVH earthquake can be considered equal 0.73 of SL-2 (refer to [d7]).

c. SL-1 earthquake

Earthquake which could affect the location during the operating life of the equipment to be qualified. For this type of earthquake, components shall be designed to continue to operate without modification. SL-1 event shall be assumed to occur a maximum number of 5 times. This is referred to in IEC/IEEE 60980-344 as Operating Basis Earthquakes (OBE) or S1 level

SL-1 event corresponds to an event with a probability in the order of 1/100 per year and represents an investment protection earthquake level. The infrastructure/component (nuclear and non-nuclear) must be designed to restart and operate after an SL-1 event without special maintenance or check.

The SL-1 spectrum can be assumed equal to 0.34 of SL-2 spectrum in the structure (refer to [d7]).

d. FRS for Pump

The Floor Response Spectra here below represent the SL-2 FRS in the installation area of Main Skids.

Damping value considered for mechanical skids in ITER standards for SL-2 is 3% as per [r4].

Damping to be considered for SL-1 Seismic Event is equal to 2%.

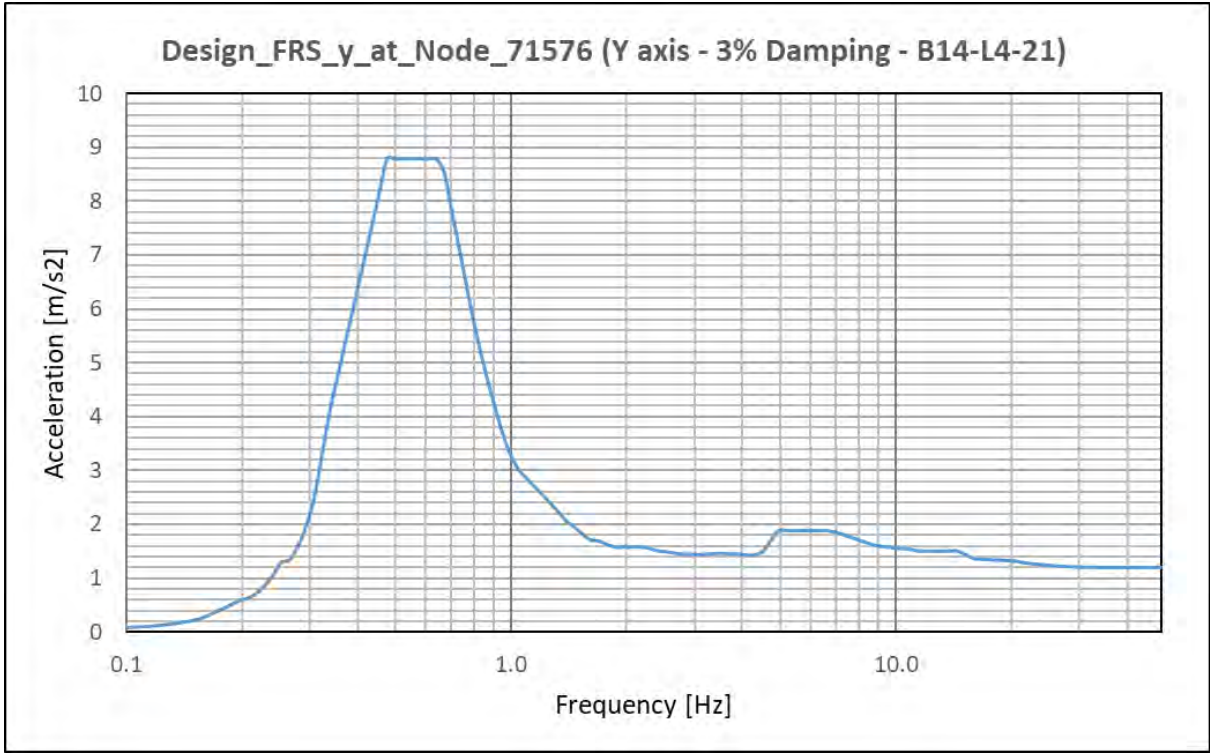
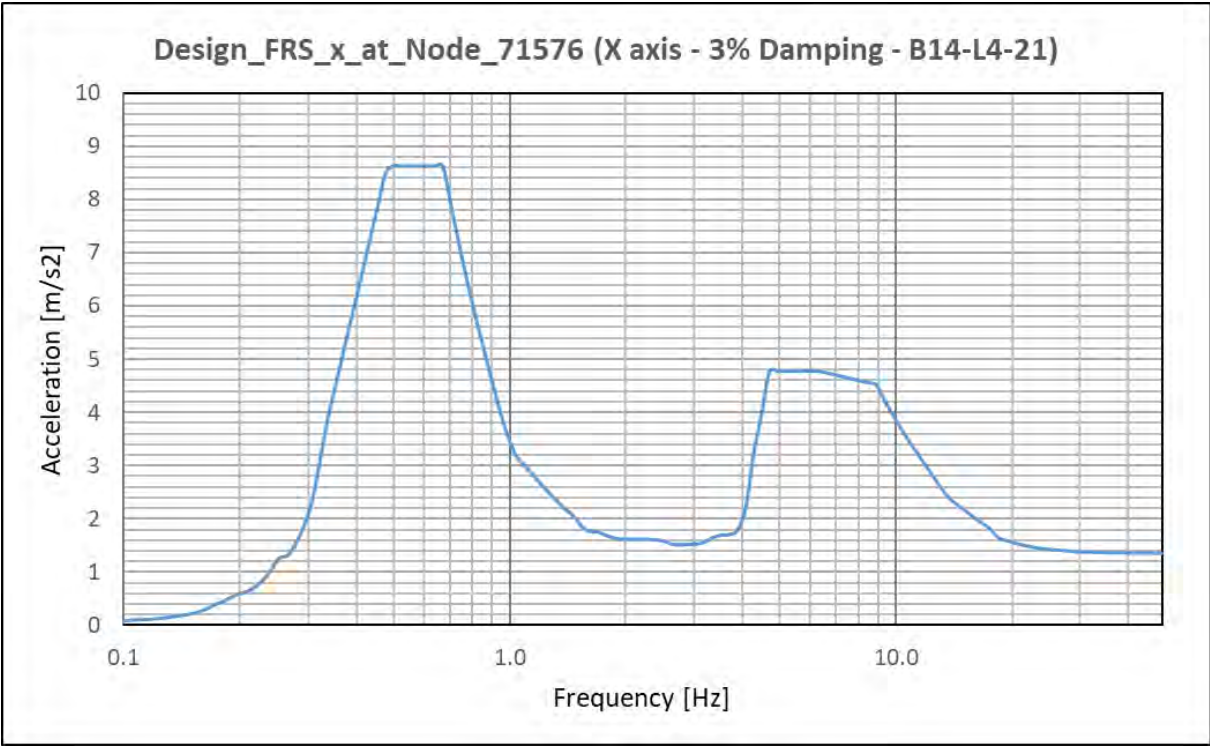
Damping to be considered for SMHV Seismic Event is equal to 3%.

Contractor to check and validate the damping factor to be applied.

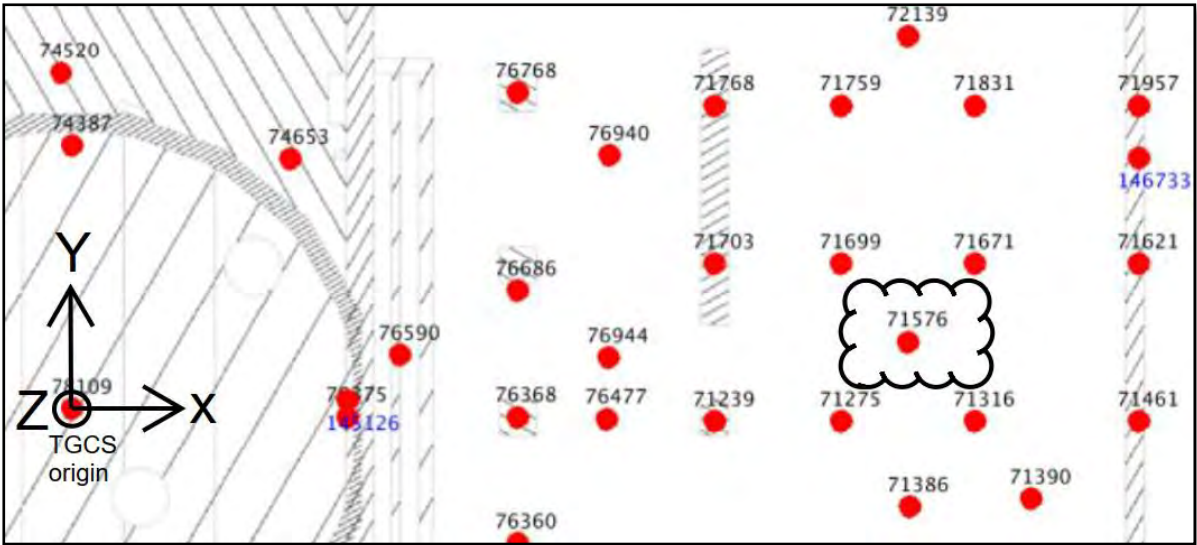
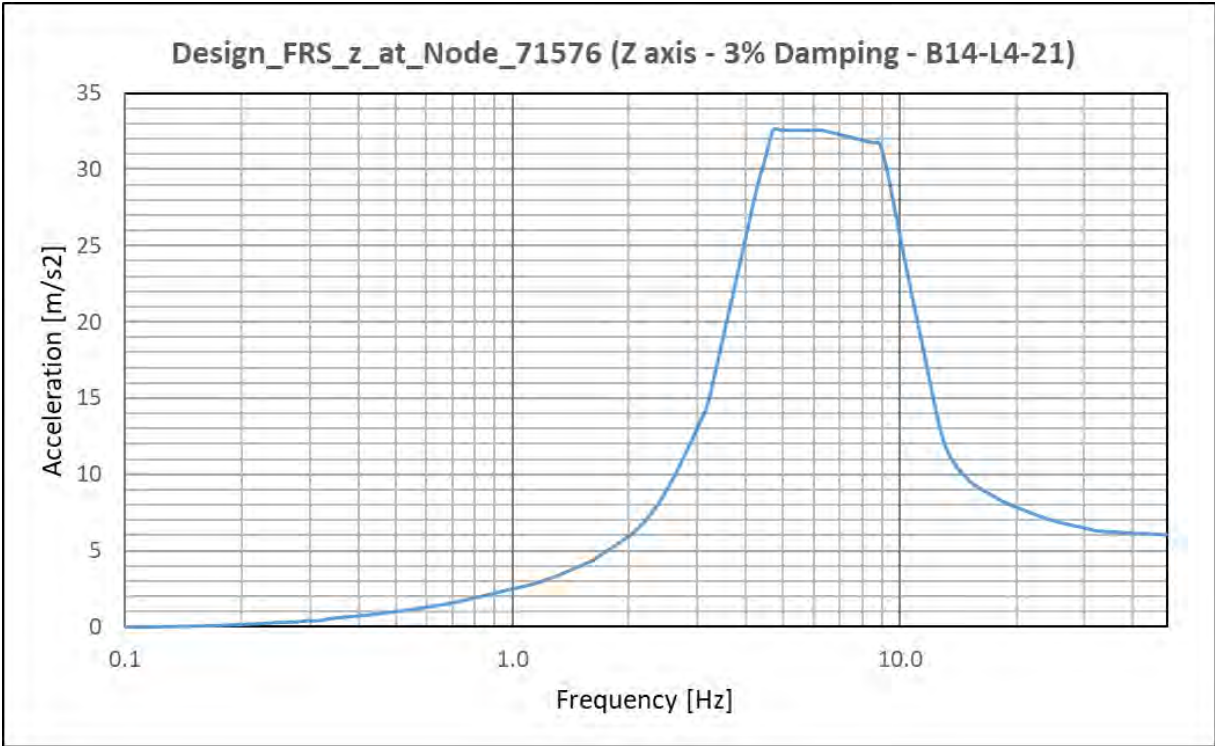
Full FRS set of data for main skid installation area at different damping ratios is given in [d61].

e. Deleted

SUPPLY



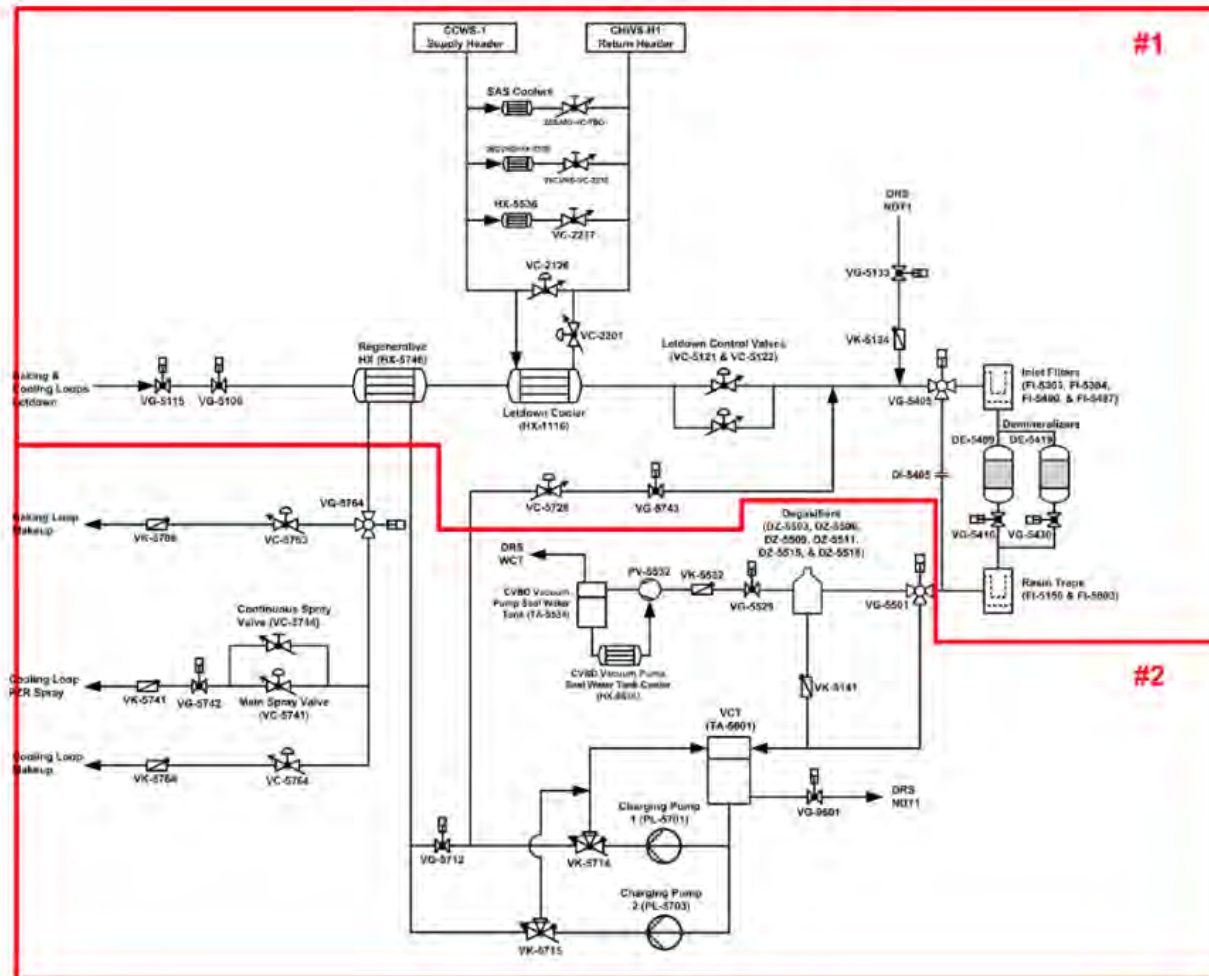
SUPPLY



SUPPLY

Appendix F – Simplified CVBD PFD

Figure 1-1: CVBD PFD Numbers



Note : This simplified CVBD PFD is extracted from Figure 1-1 of YFLDNY_v1.0(TCWS IBED CVCS (CVBD) Process Flow Diagram (PFD)).

SUPPLY

Appendix G – General instructions for CE Marking

The **Supplier shall determine EC/EU Directives and/or Regulations requiring CE Marking that apply to components/equipment/assemblies in the scope of Contract.**

For information, the main EC/EU Directives and Regulations applicable to the scope of IO Contracts are:

- Machinery Regulation (EU) 2023/1230
- Pressure Equipment Directive 2014/68/EU
- Electromagnetic Compatibility Directive 2014/30/EU
- Low Voltage Directive 2014/35/EU

The Supplier, or Subcontractor(s), **is considered the Manufacturer of components/equipment/assemblies in the scope of Contract.** The Supplier, or Subcontractor(s), shall perform Conformity Assessment, affix the CE Marking and issue EU Declaration(s) of Conformity where EU Directives and/or Regulations that require CE Marking apply.

The Supplier shall deliver components/equipment/assemblies certified and **CE marked at the highest possible integration level**, i.e. at the level of independent functional units (assemblies).

IO does not perform certification/ CE marking or integration under national legislation of components/equipment/assemblies included in the Supplier's scope of Contract unless otherwise specified in the Contract.

Remark: Equipment/assemblies composed of CE marked components also require Conformity Assessment and CE marking at equipment/assembly level.

The Supplier shall ensure that sub-contracted or purchased components/equipment/assemblies comply with EC/EU Directives and/or Regulations that require CE Marking where applicable.

This includes verifying CE Marking, EC/EU Declarations of Conformity and operating and maintenance instructions.

Where the scope of Contract includes components/equipment/assemblies creating potentially explosive atmospheres during operation or maintenance (e.g. by releasing flammable gases or vapours in sufficient quantities) or is specified to operate in potentially explosive atmospheres (e.g. where flammable gases or vapours are present in sufficient quantities due to other sources) the Supplier shall ensure that activities related to explosion protection are carried out by personnel with sufficient qualification and experience.

Where the scope of Contract is limited to design activities up to the Final Design stage, **the Supplier shall define all verification tests required for CE Marking**, e.g. electrical safety tests, to be performed during Factory and/or Site Acceptance Tests.

SUPPLY

The Supplier shall provide the following documents for IO's review and acceptance:

1. Results of **Supplier's analysis regarding applicability** of EC/EU Directives and/or Regulations to the scope of Contract and a CE Marking strategy for the complete scope of Contract at the level of independent functional units (assemblies) As part of the Design Report or separate document at the FDR.
2. Manufacturer's EC/EU **Declaration(s) of Conformity**, and, if applicable, documents issued by Notified Bodies in the course of Conformity Assessment latest 15 working days prior to the transfer of ownership to IO (if not otherwise specified in the Contract).
3. **Operating and maintenance instructions** in English and in the national language of the country of destination latest 15 working days prior to the transfer of ownership to IO (if not otherwise specified in the Contract). [1], Section 8.9, provides assistance on instructions for machinery.
4. Emissions and immunity test records of apparatus intended for incorporation into a particular Fixed Installation and otherwise not made available on the EU market according to Art. 19 of Directive 2014/30/EU, Electromagnetic Compatibility, latest 15 working days prior to the transfer of ownership to IO (if not otherwise specified in the Contract).
5. Upon request, records of electrical safety tests performed during manufacturing, factory or site acceptance tests.
6. Upon request, technical documentation related to hazard identification, risk evaluation and risk mitigation of the component/equipment/assembly.
7. Upon request, other technical documentation related to design, manufacturing and erection of the component/equipment/assembly as necessary for integration into a higher level assembly and Conformity Assessment by another party.

Under certain conditions, the Directives 2006/42/EC and Regulation 2023/1230 on Machinery, Art. 1(2)(c), and 2014/68/EU on Pressure Equipment, Art. 1(2)(h), exclude items for nuclear use from their applicability.

If the Supplier considers that the scope of Contract falls, partially or entirely, under these exclusions, the Supplier shall:

- Submit to IO a technical justification substantiating the applicability of the exclusion,
- Request IO's acceptance.

In case that no acceptance is granted by IO, CE Marking applies.

The same applies for any other exclusion from any EC/EU Directive or Regulation requiring CE Marking deemed applicable by the Supplier.

Note : This general instruction is extracted from Page 45 of [r22].

ANNEX I

EXPRESSION OF INTEREST & PIN ACKNOWLEDGEMENT

To be returned by e-mail to: Jingyu.Gao@iter.org and cc. Andrew.Brown@iter.org

Tender reference: **IO/26/OT/10035629/JGO**

Description: **Supply Contract for Canned Motor Pumps of Chemical and Volume Control System (CVBD) and Vacuum Vessel Primary Heat Transfer System (VV PHTS)**

Procurement Officer: **Jingyu Gao**

Company Name:

Country of Origin:

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

☐ WE INTEND TO SUBMIT A TENDER

☐ WE ARE ALREADY REGISTERED IN IPROC

☐ WE INTEND TO REGISTER IN IPROC

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

Name	E-mail
...	...

.....

Signature:

COMPANY STAMP

Name:

Position:

Tel:

E-mail.....

Date: