外部委託業者の募集

References: IO/24/CFT/10030698/VML

"Procurement of Design, Manufacturing, Testing, Installation and Commissioning of the Stage 2 Main Coil Power Converters "

（ステージ２コイルコンバーターの設計、製造、試験、設置、試運転作業の調達）

IO 締め切り 2025 年 1 月 24 日(金)

〇目的

この文書は、ITER 機構（IO）が調達する必要があるステージ 2 メインコイルパワーコンバータ（MCPC）の技術要件の概要を示しています。

ステージ 2 の MCPC には、以下の項目が含まれます：

PF AC/DC パワーコンバータ 2 台

CS AC/DC パワーコンバータ 6 台

VS1 AC/DC パワーコンバータ 4 台

これらのユニットは、IO によって調達され、デザイン、製造、試験、設置、試運転（Commissioning)、および SAT（Site Acceptance Test）を含む完全なターンキー契約のもとで提供されます。これには、電力コンバータおよびその補助システム（高低電圧電力分配、計測・制御システム、冷却水分配、機械構造、DC バスバー）の設計・製造・試験・設置などが含まれますが、これに限られません。

この文書の目的は、この入札およびその後の契約に参加を希望する企業またはコンソーシアムに対し、予備的な情報を提供することです。最終的な技術仕様書は後日発行され、その仕様書が入札のために考慮される唯一の技術文書となります。

〇 背景

1 ITER

ITER 機構（IO）は、初期の建設活動が進行中の国際共同研究開発プロジェクトです。IO の 7 つのメンバーは、欧州連合（F4E によって代表される)、日本、中国、インド、大韓民国、ロシア連邦、アメリカ合衆国です。

このプロジェクトは、平和的目的のための融合エネルギーの科学的および技術的実現可能性を示し、最初の電力生産融合炉の設計、建設、運転に必要なデータを収集することを目的としています。また、完全規模の融合発電所に必要となる加熱、制御、計測、遠隔メンテナンスなどの重要技術も試験する予定です。

ITER の敷地はフランスのブーシュ＝デュ＝ローヌ県にあり、IO の本部と建設現場があります。施設の建設は進行中です。詳細情報は IO のウェブサイト（http://www.iter.org）で確認できます。

2.2 コイルパワー供給および分配システムの概要

ITER のコイルパワー供給および分配システム（PBS 41）は、以下の主要なサブシステム/プラントで構成されています：

400/66/22 kV パルスパワー電力ネットワーク（PPEN）
66 kV 無効電力補償および高調波フィルタリング（RPC & HF）
コイルパワー供給 AC/DC コンバータ
スイッチングネットワークユニット（SNUs）、高速放電ユニット（FDUs）、保護用メイクスイッチ（PMSs）、DC バスバー、計測器
PPEN は、400 kV グリッドから電力を受け取り、それを 66 kV および 22 kV のレベルでコイルパワー供給システム（CPSS）および加熱・電流駆動（H&CD）システムに配分します。
RPC & HF システムは、無効電力の流れを制御し、高調波フィルタリングによってグリッドおよび PPEN の電圧変動を低減します。
AC/DC パワーコンバータは、ITER の超伝導磁石コイルに制御された電圧/電流を供給し、プラズマの立ち上げ、プラズマ電流、形状および位置の制御、誤差場の補正を行います。
FDU は、コイルの急冷時に蓄積されたエネルギーを迅速に放電して保護します。
SNU は、プラズマ立ち上げ用の電圧を供給し、AC/DC コンバータを補完します。

2.3 ステージ 1 およびステージ 2 メインコイルパワーコンバータ
TF、PF、CS、CC コイルに電力を供給する必要があるメインコイルパワーコンバータは、2 段階で調達されます：

ステージ 1 のパワーコンバータはすでに試運転段階にあります。
ステージ 2 のパワーコンバータは、新しい ITER ベースライン 2024 に基づいて調達される予定です。
ITER ベースライン 2024 では、DT 実験段階が「研究運用開始」（SRO）という単一の段階に統合されました。SRO 前には「研究運用開始前組立」（Pre-SRO Assembly）という組立段階があり、その後、DT フェーズ DT-1 に必要なシステムを設置する「研究運用開始後組立」（Post-SRO Assembly）段階があります。したがって、ステージ 1 およびステージ 2 の両方のパワーコンバータは SRO に必要であり、Pre-SRO Assembly 段階で組み立てが行われる必要があります。
ステージ 1 のパワーコンバータは、中国および韓国の国内機関によってインカインドで提供され、サイリスタベースの直線整流コンバータ技術が使用されています。調達プロセスは現在、現地での設置と試運転の段階にあります。
ステージ 2 で必要とされるコンバータは調達および試運転され、既存のステージ 1 のコンバータと直列接続されます。この調達はターンキー契約として行われ、設計から製造、成功した現地試運転およびコンポーネントの引き渡しまでが含まれます。

以下の表は、ステージ 1 およびステージ 2 のパワーコンバータユニットの種類、定格、数量を示しています。

○ 技術要件と供給範囲

3.1 機能要件

各コンバータユニットは、指定された電気回路（PF1、PF6、CS、VS1）を通じて、既存のステージ1コンバータと直列接続され、以下の主要な機能を果たします：

1. **電力の受信と変換**
   66 kV AC バスバーから電力を受け取り、AC 電力を変換して、超伝導コイルに DC 電力を供給します。
2. **DC 電圧供給**
   対応する回路コントローラの指令に従い、±1.05 kV（負荷時）の DC 電圧を供給します。コマンドに対する電圧の応答は線形的に制限され、次の要件を満たす必要があります：
   - (+)から(-)、および(-)から(+)への電圧応答時間が対称であること。
   - (+)から(-)、および(-)から(+)への完全な電圧変化が、PF および CS の場合は 2 つの電気的サイクル（40ms、50Hz で 360°）内で、VS コンバータの場合は 1 つの電気的サイクル（20ms、50Hz で 360°）内で達成されること。
3. **連続運転時の電流供給**
   電流供給は、DC バスバーの接続の極性変化なしで、連続的に行われること（すなわち、四象限動作）。具体的には、VS1 では±22.5kA、CS では±45kA、PF では±55kA の範囲。
4. **超伝導負荷の特性に対応した要求**
   超伝導磁石は非常に高いインダクタンスと蓄積エネルギーを持つため、電流循環回路が開く可能性を防ぐ必要があります。以下の特別な要件があります：
   - 電流ゼロ交差時にデッドタイムなしで電流極性を変更すること。
   - インバータ/整流器ブリッジの半導体デバイスを切断する際に、負荷電流のフリーウィーリングパスを提供すること。
5. **制御機能の提供**
   以下の制御機能を提供する必要があります：
   - 実時間での運転制御および監視（電圧制御および電流制御）。
   - 設備保護および緊急停止用のインターロック。
   - 人員安全の制御および監視。

3.4 材料の範囲

各ステージ 2 コンバータには、以下の項目が含まれます（機能定格および要件に基づく）：

1. **AC 側の回線切断および接地装置**（IO のフィーダケーブルとのインターフェース）。
2. **コンバータトランスおよび金属封入 AC バスバー**（B32 および/または B33 の壁を貫通する）。
3. **AC/DC コンバータ**（必要な電圧または電流スムージングデバイスを含む）。
4. **DC 切断および接地スイッチ**。
5. **DC 相互接続バスバーおよびリンク**（既存の DC バスバーに接続して、既存のステージ 1 パワーコンバージョンサーキットに挿入）。
6. **水冷パイプ、バルブおよび計測機器**（既存の冷却水システムサービスポイントとのインターフェース）。

7. **制御および保護のための計測および制御システム周辺機器**（ローカルの従来の制御、インターロックおよび安全制御を実行し、既存の回路コントローラや他の制御システムとのインターフェースを行う）。
8. **5 年間の運用に必要な予備部品および保守**。

○ 作業範囲

1 供給範囲

この契約は完全なターンキー契約となります。作業範囲には、以下が含まれます：

(i) 初期設計：

a. **技術解決策の選定**（パワーコンバータ用）。

b. **技術解決策の技術的実現可能性の確認**（主要コンポーネントの設計説明、負荷仕様および正当化計画の更新）。

c. **設計正当化の将来のステップを計画**（特にプロトタイプの資格試験）。

(ii) 最終設計：

a. **インターフェース検証と仕様**。

b. **主要コンポーネントの仕様**。

c. **コンポーネントの設計**。

d. **プロトタイプ開発および試験**。

e. **制御ソフトウェア開発**。

f. **設計の正当化**（関連する方法およびツールを使用：計算、シミュレーションなど）。

g. **設計レビューの準備**（IO の手順に従って）。

(iii) 製造設計および準備：

a. **設計定義の詳細化**（製造図面、製造準備など）。

b. **全ての ICD/IS を洗練された設計定義に従って更新**。

c. **製造用部品表の作成、調達計画および MIP の作成**。

(iv) システムの製造および納品：

a. **システム製造の準備および製造**。

b. **工場出荷前試験（FAT）の実施**（IO の要求および承認された試験計画に従って）。

c. **ITER サイトへのシステムの発送**。

d. **行政手続きの管理**（通関、輸出管理など）。

(v) 組立および設置：

- システムの組立および設置作業。

(vi) 現地試運転および試運転：

a. **試運転計画の準備**。

b. **試運転の実施**。システムの試運転においては、試験中の磁石は使用できないことに注意。

c. **フランスの法的検査を完了するための IO へのサポート**。

(vii) アフターセールスサポート（運用および保守）：

a. **予備部品の提供**。

b. **予防保守および治療保守の実施**。

c. **試験結果および経験のフィードバックに基づくシステムの更新**（将来の契約で考慮される可能性あり）。

d. **磁石試験との統合試運転中のサポート**。

〇日程

IO の内部マイルストーン、他システムの統合、インターフェースシステムの設計スケジュールに基づき、以下のマイルストーンを考慮する必要があります：

外部委託の募集	2024 年 12月
入札の事前審査	2025 年 1月
入札者会議（ITER サイト）	2025 年 2月
入札フェーズ開始	2025 年 3月
契約の授与	2025 年第 4 四半期
キックオフミーティング	2025 年第 4 四半期
最終設計の完成（設計およびインターフェースが確定）	2027 年第 3 四半期まで
B32/33 での設置開始	2029 年第 3 四半期
単独試運転の終了	2032 年第 3 四半期まで

（以下詳細は英文技術仕様書を参照ください）

【※　詳しくは添付の英語版技術仕様書「**Design, Manufacturing, Testing, Installation and Commissioning of the Stage 2 Main Coil Power Converters**」をご参照ください。】

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

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

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

＜ITER 機構から参加極へのレター＞

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

Route de Vinon-sur-Verdon - CS 90 046 - 13067 St Paul Lez Durance Cedex - France

Reference: IO/24/CFT/10030698/VML

Subject: Call for Nominations for the Procurement of Design, Manufacturing, Testing, Installation and Commissioning of the Stage 2 Main Coil Power Converters

Dear Colleagues,

The ITER Organization is pleased to invite the Domestic Agencies to nominate companies, institutions or other entities that would be capable to supply the IO with a Stage 2 Main Coil Power Converters (MCPC):

The Stage 2 MCPC include the following items:

- 2 units of PF AC/DC power converter;
- 6 units of CS AC/DC power converter;
- 4 units of VS1 AC/DC power converter.

china
eu
india
japan
korea
russia
usa

These units are to be procured by the IO, with a full turnkey contract that will include, but not limited to, the design, manufacturing, testing, installation, commissioning and SAT of the power converters and their auxiliary systems (Medium & Low Voltage electrical distribution, instrumentation and control systems, cooling water distribution, mechanical structures and the DC interconnecting busbars).

Please find enclosed the Technical Summary and the tentative schedule for the tender below:

Call for Nomination Issuance	18 December 2024
Call for Nomination due date	13 January 2025
Launch of the Prequalification phase of the Call for Tender	January 2025
Bidders conference on ITER site	February 2025
Launch of the tender phase for the Call for Tender	March 2025
Award of the Contract	Q4-2025
Kick-of meeting	Q4-2025

The potential Candidates should have a recognized level of expertise, skills and demonstrated experience in the field mentioned above, as well the financial capability.

Could you please provide Procurement Division with a list of suitable potential Candidates, mentioning their up-to-date contact details using the attached excel template. Then, the ITER Organization will invite them to prequalify.

Contact: Virginie Michel –Procurement Division - Tel. +33 (0)4 42 17 84 93- e-mail: virginie.michel@iter.org

Please send your proposals by e-mail to virginie.michel@iter.org by latest **13 January 2025**.

Yours faithfully,

Virginie Michel
Procurement Officer
Procurement Operational Delivery Group (POD)

Annexes:
- Nominations template
- Technical Summary IDM UID ADLWGT

IDM UID
ADLWGT

VERSION CREATED ON / VERSION / STATUS
11 Dec 2024 / 1.1 / Approved

EXTERNAL REFERENCE / VERSION

Pre-Qualification Documents

Technical Summary for Procurement of Design, Manufacturing, Testing, Installation and Commissioning of the Stage 2 Main Coil Power Converters

This document outlines a summary of the technical requirements of the Stage 2 Main Coil Power Converters (MCPC) that needs to be procured by the ITER Organization (IO).

The Stage 2 MCPC include the following items: 2 units of PF AC/DC power converter; 6 units of CS AC/DC power converter; 4 units of VS1 AC/DC power converter.
These units are to be procured by the IO, with a full turnkey contract that will include, but not limited to, the design, manufacturing, testing, installation, ...

Technical Summary for the Call for Nomination for the Call for Tender for:

Design, Manufacturing, Testing, Installation and Commissioning of the Stage 2 Main Coil Power Converters

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1 Purpose

This document outlines a summary of the technical requirements of the Stage 2 Main Coil Power Converters (MCPC) that needs to be procured by the ITER Organization (IO).

The Stage 2 MCPC include the following items:

- 2 units of PF AC/DC power converter;
- 6 units of CS AC/DC power converter;
- 4 units of VS1 AC/DC power converter.

These units are to be procured by the IO, with a full turnkey contract that will include, but not limited to, the design, manufacturing, testing, installation, commissioning and SAT of the power converters and their auxiliary systems (High & Low Voltage electrical distribution, instrumentation and control systems, cooling water distribution, mechanical structures and the DC busbars).

This document has the objective to provide preliminary information to potential companies or consortia that are interested in participating in the call for nomination for this tender and subsequent contract. The final technical specifications will be issued later and will be the only technical document to be considered for biding.

2 Background

2.1 ITER

The ITER Organization (IO) is a joint international research and development project for which the initial construction activities are underway. The seven members of the IO are the European Union (represented by F4E), Japan, the People's Republic of China, India, the Republic of Korea, the Russian Federation and the USA.

The project aims to demonstrate the scientific and technological feasibility of fusion power for peaceful purposes and to gain necessary data for the design, construction and operation of the first electricity-producing fusion plant. It will also test a number of key technologies, including the heating, control, diagnostic and remote maintenance that will be needed for a full-scale fusion power station.

The ITER site is in the Bouches du Rhône district of France. It includes the Headquarters of the IO and a construction worksite. The construction of the facility is on-going. Further information is available on the IO website: http://www.iter.org.

2.2 Coil Power Supplies and Distribution System Overview

ITER Coil Power Supply & Distribution Systems (PBS 41) comprise of following major subsystems/plants:

- 400/66/22 kV Pulse Power Electrical Network (PPEN);
- 66 kV Reactive Power Compensation and Harmonic Filtering (RPC & HF);
- Coil Power Supply AC/DC Converters;

- Switching Networks Units (SNUs), Fast Discharge Units (FDUs), Protective Make Switches (PMSs), DC Busbars and Instrumentation.

PPEN receives power from the 400kV Grid and distributes (@ 66kV& 22kV level) it to the pulsed loads of Coil Power Supply Systems (CPSS) and Heating & Current Drive (H&CD) Systems.

RPC & HF system reduces the voltage fluctuations in the Grid and PPEN by control of reactive power flow and harmonic filtering.

AC/DC power converters, with a total installed power of about 2.2GVA, provides the controlled voltage/current to the ITER superconducting magnet coils for plasma initiation, plasma current, shape and position control, and error field correction.

FDUs provide protection of the coils by fast discharge of the stored energy in case of quench. SNUs provide voltage for plasma initiation, supplementing the a.c./d.c. converters.

2.3 Stage 1 and Stage 2 Main Coil Power Converters

The Main Coil Power converters, which are required to supply the TF, PF, CS and CC coils, are procured in 2 stages:

- Stage 1 power converters are already in commissioning stage;
- Stage 2 power converters are to be procured in accordance with the new ITER baseline 2024.

In ITER baseline 2024, the DT experimental phase is consolidated into a singular phase termed "Start of Research Operations" (SRO). There is a solitary assembly stage before SRO, named "Pre-Start of Research Operations Assembly" (Pre-SRO Assembly), and a subsequent assembly phase, "Post-Start of Research Operations Assembly " (Post-SRO Assembly), dedicated to installing systems required for the inaugural DT phase, DT-1. Therefore, both the stage 1 and stage 2 power converters are required for SRO and should be assembled in the stage of Pre-SRO Assembly.

The power converters of Stage 1, including all the accessories have been provided as in-kind contribution by the Chinese and Korean Domestic Agencies. These converters are utilizing thyristor-based line commutated converter technology. The procurement process is currently at the stage of on-site installation and commissioning.

The converters required for the Stage 2 are to be procured and commissioned and will be in series connected with the existing stage 1 converters. This procurement is to be a turn-key project: a single contract including from design, manufacturing until the successful site commissioning and handover of components.

The table below indicates the type, rating and number of power converters units in Stage 1 and 2.

Table 2-1 Type and number of converter units in 2 stages

Type	Total units	Ratings of each unit	Stage 1 units (already manufactured)	Stage 2 units (to be procured)
Toroidal Field (TF)	1	±160/650V, 68 kA	1	0
Poloidal Field (PF)	16	±1050 V, ±55 kA	14	**2**
Central Solenoid (CS)	12	±1050 V, ±45 kA	6	**6**
Vertical Stabilization (VS1)	6	±1050 V, ±22.5 kA	2	**4**
Correction Coil (CC)	9	±300 V, ±10 kA ±85 V, ±10 kA	9	0

The following block diagram presents the configuration, ratings of powers converters in two stages and the procurement sharing of stage 1. The stage 2 power converters are highlighted in the purple rectangles.

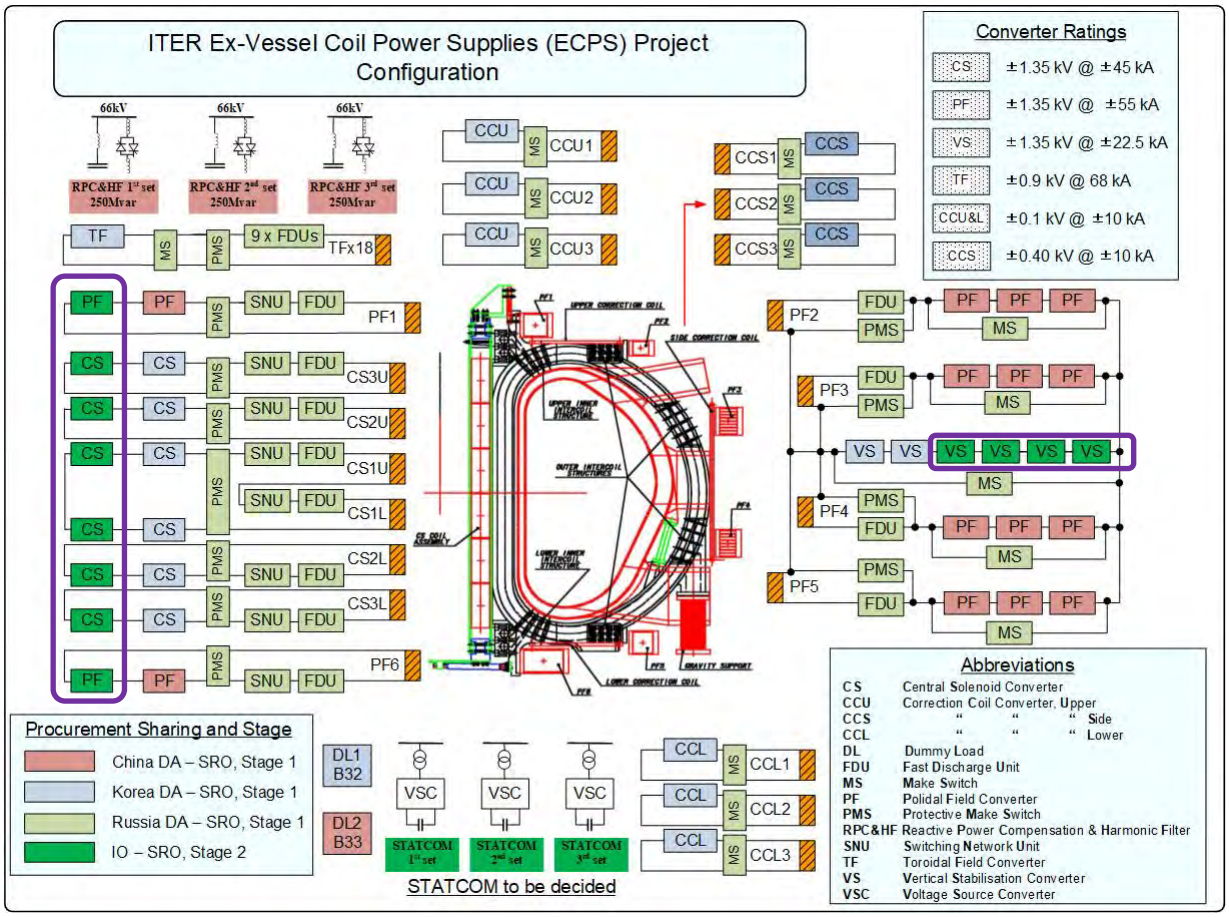

Figure 2-1 Block diagram of ECPS system ratings and procurement sharing

3 Technical Requirements and Scope of Supply

3.1 Functional requirements

Each converter unit shall be connected in series to the existing stage 1 converter(s) in designated electrical circuit (PF1, PF6, CS and VS1) through the DC interconnecting busbars, and perform the following main functions:

1. Receive power from the 66kV AC busbar, convert the AC power and supply the DC power to the superconducting coils;

2. Supply the DC voltage (within the range of ±1.05kV, on-load) per commanded by the corresponding circuit controller (command frequency at 1 kHz); the voltage response to command shall be linearly rate limited such that:

   - The response time of the voltage from (+) to (-) and from (-) to (+) is symmetric;

   - The full scale voltage change from (+) to (-) and from (-) to (+) is accomplished within two electrical cycles (40 ms based on 360° at 50Hz) for PF and CS, or 1 electrical cycle (20 ms based on 360° at 50Hz) for the VS converters;

3. Continuous-duty supply current (within ±22.5kA for VS1, ±45kA for CS and ±55kA for PF) without polarity change of DC busbar connections (i.e. four-quadrant operation).

4. The power converters supply superconductive magnets, which are characterised by very high inductance and stored energy. Therefore, it is necessary to prevent the possibility of opening the current circulation circuit. The following requirement are specially required because of the superconductive loads:

   - Current polarity change with continuous current circulation (i.e. no dead time during current zero-crossing).

   - Freewheeling path of the load current in case of turning-off the semiconductor devices of the inverter/rectifier bridge.

5. Provide control functions consisting of:

   - Real time operational control and monitoring (for voltage control and current control);

   - Interlocks for investment/equipment protection and emergency shutdown;

   - Personnel safety control and monitoring.

3.2 Applicable standards and codes

For electrical and power electronics components, the applicable standards to be considered for the design, manufacturing, installation and operation of the stage 2 converter are listed in the ITER Electrical Design Handbook - Codes & Standards (TR-20-005), available on the ITER website. However, the main ones are listed hereafter:

- NF C 13 200: High voltage electrical installations*
- NF C 15 100: Low-voltage electrical installations*

- NF C 18 510: Operations on electrical network and installations and in an electrical environment*
- IEC 60146: Semiconductor converters
- IEC 60076: Power transformers
- IEC 61000: Electromagnetic compatibility

* Considering the specificity of the French standards, the IO will involve its technical experts or an external third party during the execution of the contract and the gate reviews to guide the contractor in the implementation of these standards. After the completion of the installation, an inspection will be performed by an independent entity, to check the compliance of the system with the applicable French standards (NF C 13 200, NF C 15 100 and NF C 18 510 mainly). The completion of this inspection will be a condition to close this contract.

For mechanical structural components (including their fixations…), mechanical integrity verifications will have to be produced by the contractor, using the set of Eurocodes and/or ESME codes.

3.3 Technical solutions

The converter topology and technology adopted for the Stage 1 main coil power converters is based on the industrial products available in 2010 when the Conceptual Design was developed. The industry is currently developing new products and two technical solutions may be considered for implementing the Stage 2 power converters:

1. Thyristor-based Converters (also known as Line Commutated Converters);

2. Voltage Source Converters.

The Stage 1 power converters are based on Thyristor-based converter technology, which has been widely used in the power supplies of the existing Tokamaks and industrial high current DC applications. In this power converter, the key semiconductor devices are high power thyristors (half-controlled device).

The Voltage Source Converter (VSC) technology is expanding the industrial areas of applications including high power applications. The semiconductor devices of this power converter are high power full controlled semiconductor devices, such as IGBT, IGCT etc. The additional controllability gives many advantages, notably the ability to switch the semiconductors on and off many times per cycle in order to improve the harmonic performance, the fast response of DC voltage output, and the fact that (being self-commutated) the converter no longer relies on AC system for its operation. Considering the thyristor based solution is selected for stage 1 and the potential of VSC technology, IO requires the supplier to provide:

- thyristor based solution for 2 PF and 6 CS converters;
- either thyristor-based or VSC based solution for 4 VS1 units.

Even if both thyristor based and VSC solutions are commonly implemented in industrial applications, it is not likely to request a direct supply without R&D or prototyping since the application in ITER coil power supply is regarded as very special in terms of voltage & current level and the control & operation modes. Therefore, the supplier shall develop the full scale

prototyping for the stage 2 MCPC. The prototype, once fully demonstrated, can be used as one of the units for the final delivery.

Before launching this procurement for stage 2, IO has already constructed the building and other relevant supporting system based on the stage 1 converter solutions. These interface systems are covered in this document to provide impacting information to the suppliers. However, during the call for tender phase, the bidders will be able to propose their own solutions, with the condition that they respect the mandatory requirements that will be included in the final technical specifications.

3.4 Scope of materials

Each Stage 2 converter shall include the following items with respect to the functional ratings and requirements:

1. AC side line disconnection and earthing devices (to interface with IO feeder cables);
2. Converter transformers and metal-enclosed AC busbars penetrating the wall claddings of B32 and/or B33;
3. AC/DC converters with necessary voltage or current smoothing devices;
4. DC disconnecting and earthing switches;
5. DC interconnecting busbars and links (connecting to existing DC busbar to insert into existing stage 1 power conversion circuits);
6. Water cooling pipes, valves and and instrumentation (to interface with existing cooling water system service points).
7. Instrumentation and control system ancillaries for control and protection (to perform local conventional, interlock and safety control, and interface with existing circuit controller and other control systems).
8. Spare parts and maintenance for 5 years of operation.

Each Stage 2 converter is integrated with an existing circuit. Figure 3-1 shows a simplified diagram of integration of stage 2 with existing System, Structure, and Components (SSCs, applicable for PF and CS cases), and Figure 3-2 shows a 3D model of PF1 converter unit that are used to illustrate the scope of contract objects. For VS1 stage 2 cases, the 4 new units will be in series and insert into the circuit of VS1 with existing VS1-1 and VS1-2 converters.

The DC output terminals of a Stage 2 converter unit must be connected to the DC interconnecting busbars. Figure 3-4 shows a conceptual scheme of DC interconnecting busbars (blue rectangle) to connect PF6 stage 1 and PF6 stage 2 power converters. The design and development of the stage 2 interconnecting busbars and interface links are in the scope of this tender. The ratings of the DC busbars shall be in line with the ratings of the converter circuits.

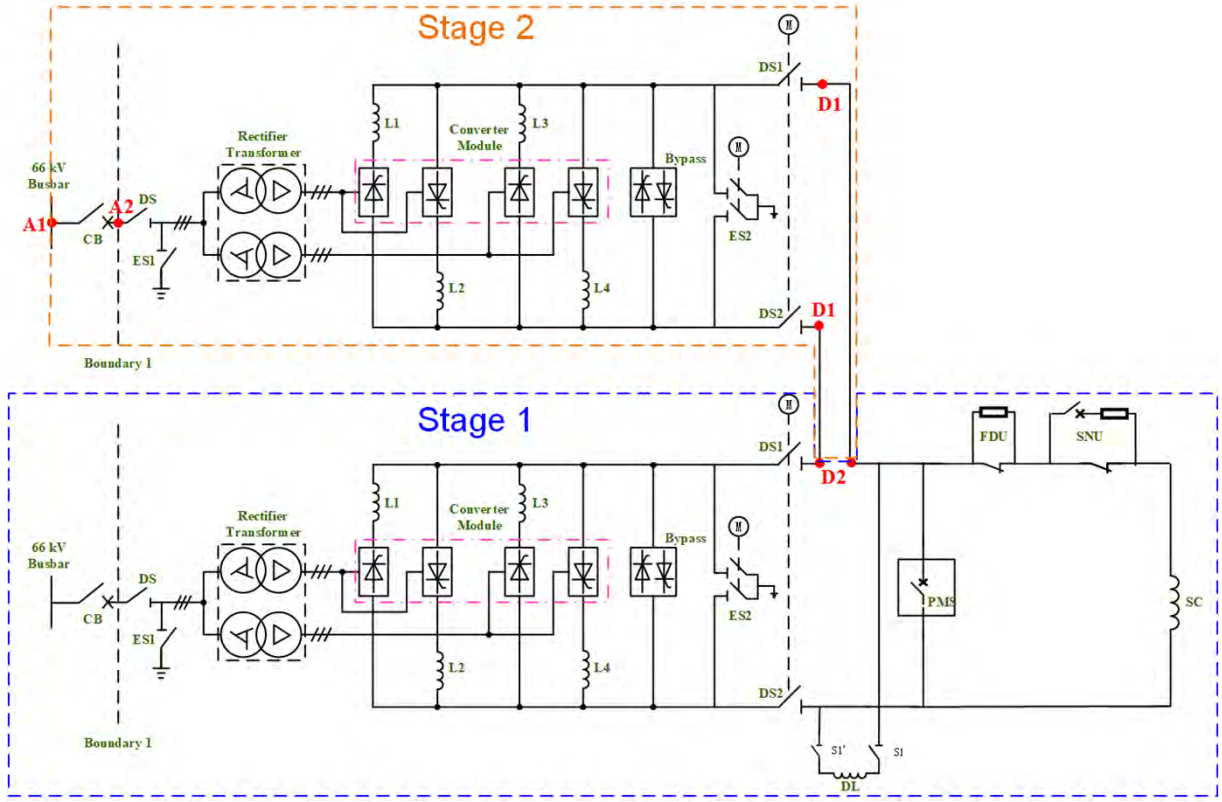

Figure 3-1 simplified diagram of PF1 power supply with configuration of stage 1 and stage 2

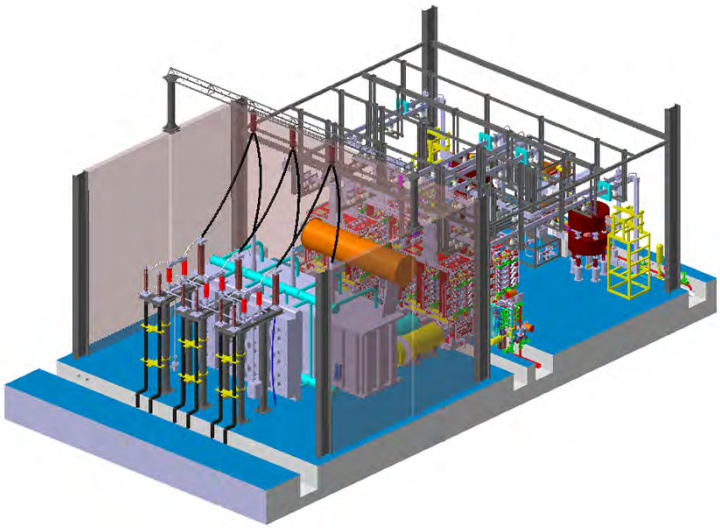

Figure 3-2 3D model of PF1 converter unit (stage 1) with foundation and supports

3.5 Building, interface and constraints

The section provides general description of the critical interfacing systems and requirements. The detailed list of the interface systems and requirements will be specified in the tender technical specification.

3.5.1 Building and site

Stage 2 power converters will be installed in B32 and B33, as shown in Figure 3-3. The geographical layout of Stage 2 power converters in B32 and B33 is arranged as shown in Figure 3-4 (the location for each converter unit can be re-arranged).

The installation and commissioning of stage 2 power converters shall follow applicable ITER worksite policy and procedures, which is in accordance with French labour code and other relevant regulations.

A dummy load of 6.76mH inductor is equipped for each building (DL1 for B32 and DL2 for B33). The contractor shall use the respective dummy load to commissioning the power converters in the commissioning stage.

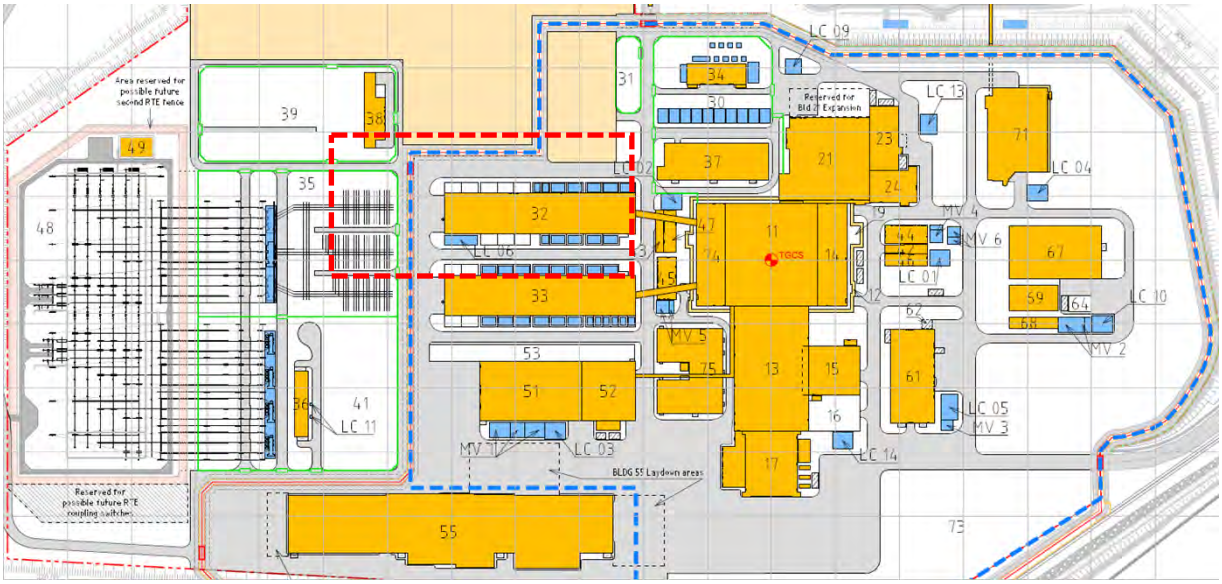

Figure 3-3 Scope definition of contract objects

Figure 3-4 Layout of main coil power supplies in B32 and B33

3.5.2 AC distribution system

IO will provide the 66kV AC cables respectively to the outside of B33 and B32 for the connection of each stage 2 power converter AC line disconnector.

The 66kV AC busbars will provide AC voltage within the range and distortion limit per specified by IEC standards.

3.5.3 Stage 1 circuit

The DC terminals of the stage 2 DC interconnecting busbars must be connected to the exiting corresponding stage 1 circuit. In the tender specifications, IO will provide a conceptual design for the stage 2 DC interconnecting busbars and the interfaces between stage 2 busbar and the stage 1 circuits. The contractor will be responsible to start from the proposed conceptual design and continue the preliminary and final design for the solution for the interface with stage 1 circuit.

3.5.4 Instrumentation and control

In addition to the development of local control system for the conventional, protection and safety control for the stage 2 power converters and their subsystem, the tender will include the development and implementation of controller(s) to interface and communicate the existing plant control and/or central control systems to achieve the following list of control functions:

- Operation command and states (reference voltage command, converter DC currents, operational states, etc) bi-directional real time communication with ITER PFCS Master Control System/central control system;
- Fault states and protections hardwired connection and network communications to the Plant Interlock Controllers.

3.5.5 Cooling water and LV power

The converter unit supply shall include the necessary pipes to the existing auxiliary services points close to the reserved installation space of cooling water and steady state AC power. The supply shall design and install, within the physical constraints, the necessary auxiliary services out of what current ITER plant can provide.

4 Scope of Work

This contract is to be a full turnkey contract. The scope of work includes the design, manufacturing, Factory Acceptance Tests (FAT), delivery, installation, commissioning and after-sales support of the complete system.

In addition, the Contractor is expected to provide all the technical documentation packages required to fulfil the IO's design procedures (design reviews, readiness reviews…).

The preliminary tasks list is indicated hereafter[1]:

(i) Preliminary design:
    a. Technical solution selection for the power converters,

[1] Specific IO procedures and the milestones list for this project will be shared in the call for tender's technical specifications.

b. Confirm the technical feasibility of the technical solution (updating the major components design description, load specification and justification plan),
c. Plan the future steps of design justification (especially qualification tests on the prototype).

(ii) Final Design:
a. Interface validation and specifications,
b. Specification of the major components,
c. Design of the components,
d. Prototype development and tests,
e. Control software development,
f. Justification of the design, using relevant methods and tools (calculations, simulations…),
g. Preparation of the design reviews, according to the IO's procedures.

(iii) Manufacturing design and preparation:
a. Refine design definition to a detailed level for the workshop execution (manufacturing drawings, fabrication, etc),
b. Update all ICD/IS according to the refined design definition,
c. Generate manufacturing Bill of materials, procurement plan and MIP.

(iv) Manufacturing of the system & delivery of the system:
a. Preparation of the Manufacturing and Manufacturing of the system,
b. Performance of Factory Acceptance Test according the IO's requirements and the approved test plan,
c. Shipment of the system to the ITER site,
d. Management of administrative procedures (customs, export control…).

(v) Assembly and installation

(vi) On-site acceptance testing and commissioning
a. Preparation of the commissioning plan
b. Performance of the commissioning. It shall be noted that the magnet under tests cannot be used for commissioning the system
c. Support to IO for completing the French legal inspection of the system.

(vii) After sales support for operation and maintenance
a. Provision of spare parts
b. Performance of preventive and curative maintenance
c. Possible system updates according to the test results and return of experience (could be considered in future contracts)
d. Support during integrated commissioning with the magnet under test.

The execution of the contract will be organized in seven activity phases and seven gate reviews as shown in Figure 4-1.

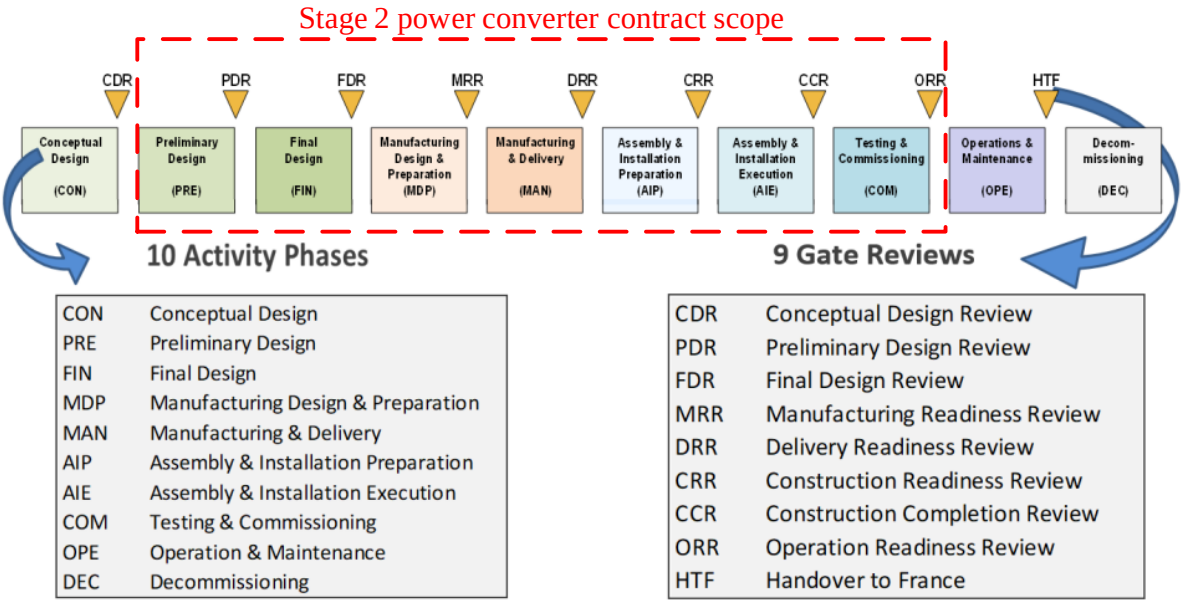

Figure 4-1 Activities phases and gate reviews as per the IO procedures.

Considering the system breakdown and the different subsystems, it will be possible to perform different activity phases and gate reviews in parallel, independently for each subsystem.

Conceptual Design (CON), Operation and Maintenance (OPE) and decommissioning (DEC) activity phases as well Handover to France (HTF) are not included in this contract. However, the supplier will be requested to provide technical and human support to IO during the first years of the Operation and Maintenance.

5 Timeline Requirements

Due to IO internal milestones, the integration of other systems in the area and the design schedule of other interfaced systems, the following milestones shall be considered for this contract:

1. Call for Nomination for the Call for Tender: Dec 2024
2. Launch of the Prequalification phase of the Call for Tender: Jan 2025
3. Bidders conference on ITER site: Feb 2025
4. Launch of the tender phase for the Call for Tender: March 2025.
5. Award of the Contract: Q4-2025
6. Kick-of meeting: Q4-2025.
7. Completion of final design (design and interfaces are frozen): no later than Q3-2027.
8. Beginning of installation in building 32/33: Q3-2029.
9. End of standalone commissioning: no later than Q3-2032.

NOMINATIONS

IO/24/CFT/10030698/VML
Procurement of Design, Manufacturing, Testing, Installation and Commissioning of the Stage 2 Main Coil Power Converters

Nominating Domestic Agency:

COMPANY NAME	WEB SITE link	POSTAL ADDRESS	POST CODE	CITY	COUNTRY	CONTACT PERSON	PHONE	E-MAIL	COMPANY INFORMATION (if any)	IO digital Procurement system (I PROC) registration number