

## Technical Summary

# Supply of Materials, Design, Manufacturing, Assembly, Delivery and On-Site Activities of TCWS Sampling System

IO/21/CFN/21947/JPA

## 1 Purpose

This is a Contract for the supply of materials, design, manufacturing, assembly, delivery and on-site activities for the TCWS (Tokamak Cooling Water System) Sampling system.

The sampling system is used to confirm whether or not the actual water chemistry meets the water chemistry specifications for primary water circuit of the ITER fusion reactor. The Sampling System provides functions to monitor water chemistry and gas chemistry in TCWS. Either on-line sampling or grab sampling is performed to measure necessary parameters. During ITER operation, sampling system is used to make sure that TCWS water chemistry remains within the prescribed limits and that tritium leakages are promptly identified. Sampling system is also part of ALARA “*As Low As Reasonably Achievable*” approach for chemistry monitoring / ACP (Activated Corrosion Product) control.

The scope of work is detailed in Section 3.0 below.

TCWS Sampling system follows a staged approach (i.e. not all systems are installed at the same time but rather in several stages, each stage being defined to validate major design assumptions). For implementation of staged approach, refer to Section 3 below.

## 2 Background

The ITER’s TCWS (Tokamak Cooling Water System) is a one-of-a-kind nuclear system that is similar in complexity and scope to the cooling systems in a commercial nuclear power plant. The cooling system will have the capacity to remove ~1 GW thermal power. The TCWS will also provide capabilities that are not usual in a commercial power plant, such as baking and drying in-vessel components and leak detection.

TCWS is based on three Primary Heat Transfer Systems (PHTSs) for cooling the Vacuum Vessel (VV PHTS), the in-Vessel components (IBED PHTS) and the Neutral Beam Injectors (NBI PHTS). It also includes auxiliary systems as the Chemical and Volume Control System (CVCS), Draining and Refilling System (DRS), and Drying System (DYS).

The system will interface with the secondary cooling system as well as with other ITER plant systems.

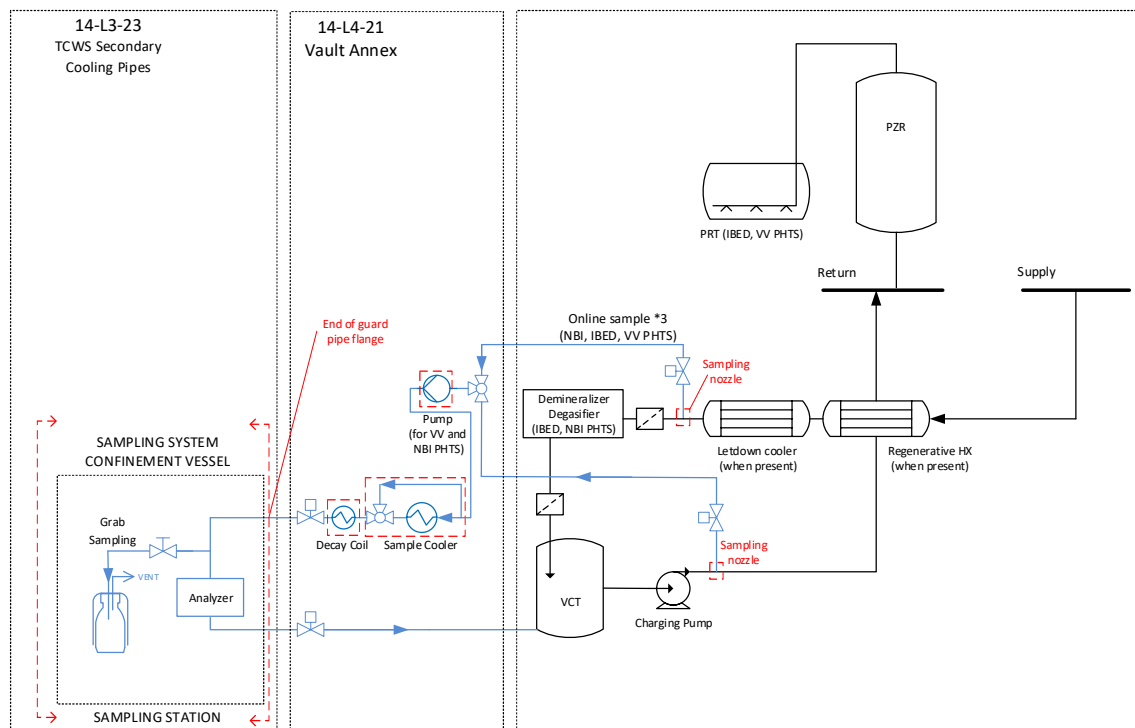
The scope of the Contract includes design and procurement of permanent (not mobile) TCWS Sampling system as well as manufacturing, assembly, delivery and on-site activities.

Figure 2-1 shows the scope of supply covered by the Contract for online and grab sampling system for three PHTS. In Figure 2-1, the red dotted lines define the scope boundaries / limits. The scope of supply covered by the Contract includes the following components:

- Sample cooler skid with mechanical temperature control
- Decay coil skid
- Sampling pump
- Sampling nozzle
- Online analyzers (sensors) for pH, conductivity, ORP, dissolved oxygen, dissolved hydrogen
- Secondary-side grab sampling station
- Primary-side grab sampling system (inside Airlock)

Online analyzers (sensors) are located inside confinement vessel in the room 14-L3-23, named Sampling station, which is also scope of supply of the Supplier (Figure 2-2, Figure 2-3 and Figure 2-4). Valves, tubing and tubing fitting located outside of the room 14-L3-23 are scope of IO.

In addition, grab sampling system for secondary side of three PHTSs will be mounted on the dedicated station which is outside of Sampling station.

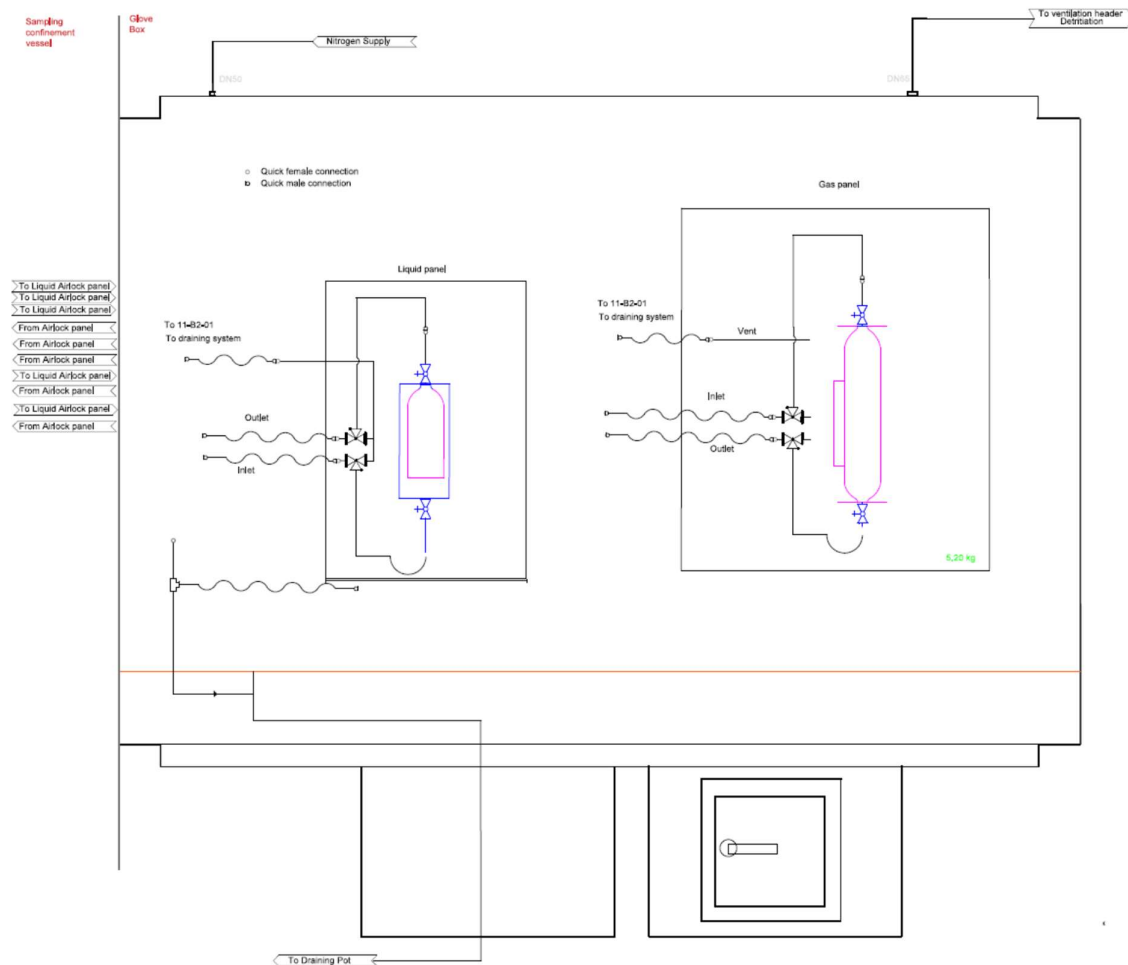


**Figure 2-1 Scope of Sampling Station for 26PHVV, 26PHNB/26CVNB and 26PHBD/26CVBD**

The scope of work also includes development of internal layout of Sampling station. Sampling station includes the following components:

- Sampling station, where online analyzers (sensors) are located
- Dynamic confinement system for Sampling Station (vessel) and airlock.
- Airlock for sampling station, where grab samples from primary water and gas are taken
- Shielded cask for transferring samples from sampling station to the laboratory





**Figure 2-4 Conceptual sketch of Airlock internal (to be located in 14-L3-23)**

### 3 Scope of work

#### 3.1 General

This Contract shall cover the supply of materials, design, manufacturing, assembly, delivery and on-site activities for the TCWS Sampling system. The detailed scope of work for the subject contract is detailed below.

#### 3.2 Detailed scope of work

The scope of work includes, but not limited to the items listed in Table 3-1.

The scope listed in Table 3-1 covers the full system configuration, which consists of both First Plasma system and Post First Plasma system. The Contract includes Stage 1 to Stage 3, and Stage 4 and Stage 5 of Table 3-1 are option. This is because the scope of supply of the Contract is limited to First Plasma scope, and Post First Plasma system is optional. (Note that the scope of the Contract for execution design and preparation of Manufacturing Readiness Review shall include full system configuration, as listed in Stage 1 of Table 3-1)

**Table 3-1 Detailed scope of work**

Activity Description	Responsible Organization	
	IO	Supplier
<b>Stage 1 “Execution Design &amp; Preparation of MRR” - First Plasma system &amp; Post First Plasma system</b>		
Execution Design & Preparation of MRR	A	R
<b>Stage 2 “Manufacture, Assembly, FAT and Delivery” - First Plasma system</b>		
Manufacturing Readiness Review (MRR)	A	R
Manufacturing	A	R
Factory Acceptance Testing	A	R
Packing and Delivery to the ITER Site	A	R
<b>Stage 3 “Acceptance” - First Plasma system</b>		
Provisional Acceptance	R/A	R
On-site Testing	R/A	R
Final Acceptance	R/A	R
<b>Stage 4 “Manufacture, Assembly, FAT and Delivery” - Post First Plasma system</b>		
Manufacturing Readiness Review (MRR)	N(*1)	N(*1)
Manufacturing	N	N
Factory Acceptance Testing	N	N
Packing and Delivery to the ITER Site	N	N
<b>Stage 5 “Acceptance” - Post First Plasma system</b>		
Provisional Acceptance	N	N
On-site Testing	N	N
Final Acceptance	N	N
<b>R</b> = Responsible for organizing, performing and for the content <b>A</b> = Review/Comment/Accept/Approve <b>N</b> = Out of scope of this Contract <b>*1)</b> Supplier shall develop the design enough mature for MRR.		

## 4 List of Deliverables

### 4.1 Hardware

The Supplier is in charge of the design, the supply and the manufacturing of the following items. The hardware to be delivered includes, but is not limited to, the following components (not exhaustive list):

- Sampling station vessel and Airlock, with all its constitutive elements (vessel, heads, nozzles, flanges, counter flanges, bolts, gaskets...)
  - Online analyzers (sensors)
  - Grab sampling system (sample bottle holder and switching valves)
  - Dynamic confinement system with pressure control, filters and fan with fan control panel
  - blind-flange (as access port)
  - interface to Shielded cask for transferring samples (leak thigh connecting between airlock and cask through a docking flange)
  - Required flanges for interface, assembly, and maintenance
- The skirt and other supports for the Sampling station and Airlock

- The liftings lugs and trunnions for the Sampling station and Airlock
- The cradles for the transportation
- The handling devices for the inspection openings
- The anchorage supports, bolts and shims
- The nameplate and its supports
- The insulation and insulation supports
- The grounding
- The tapes, gaskets and all temporary devices for the hydraulic test.
- Tube fitting material which is needed for interfacing points between IO
- Sample cooler skid with mechanical temperature control
- Decay coil skid
- Sampling pump
- Sampling nozzle
- Secondary-side grab sampling station
- Required flanges for interface, assembly, and maintenance;
- Instrumentation for flow and pressure sensing;

## 4.2 Documentation

List below is given as example; the final list will be part of the Call For Tender.

- Configuration Management Model Mock-Up (CMM)
- General assembly drawing of Sampling station
- Design Description
- Functional Analysis
- Load Specifications
- Detailed Performance Definition
- Process Flow Diagram (PFD)
- Detailed Diagrams (e.g. P&ID, SLD, routing/cabling)
- Instrumentation and Control Documents (I&C)
- Mechanical Engineering Model & Drawings
- Bill of Material (BOM) and Component Classification
- Component Technical Specifications
- Integrated Logistics Support Plan (ILS)
- Operation Plan
- Maintenance Plan
- Periodic Test and Inspections Plans
- Design Compliance Matrix (DCM)
- Design Justification Plan
- Engineering Analysis Reports and Calculation Notes
- R&D Reports (if applicable)
- Factory Qualification Test Plan
- Qualification Summary Report for SIC Components
- On Site Assembly Plan
- On Site Testing and Commissioning Plan
- Schedule

- Work Plan

## 5 Indicative Schedule

<input type="checkbox"/> Contract kickoff	Q1-2022
<input type="checkbox"/> MRR for SA Station (completion of Stage 1 of Table 3-1)	Q3-2022
<input type="checkbox"/> Delivery of SA Station (completion of Stage 2 of Table 3-1)	Q1-2023
<input type="checkbox"/> Start installation of SA Station (begin of Stage 2 of Table 3-1)	Q4-2023

## 6 Required Competences

Knowledge and experience in design for the following selected activities in nuclear environment is requested. The candidate's company and its personnel shall have adequate experience for the work as detailed below.

- Expertise in detail design, qualification, interface definition and documentation/drawing for sampling systems and instrumentation of nuclear systems,
- providing Quality Assurance level and Supply Chain Management System required for manufacturing of nuclear components, and shall comply with the French Order of 7th February 2012 establishing the general rules for basic nuclear installation,
- Process, Mechanical, I&C, Electrical and CAD design engineering,
- Expertise in manufacturing of nuclear components following international nuclear codes and standards,
- Design engineering (with the aid of CATIA V5). As per IO procedures,
- Precision stainless steel construction and fabrication,
- Manufacturing, forming and welding stainless steel Non-Destructive Testing and examination (Visual, die-penetrant, X-Ray and UT...),
- Non-Destructive Testing and examination (Visual, die-penetrant, X-Ray and UT),
- Capability to conduct acceptance testing of final components (Pressure, draining/drying, flow),
- Experience and expertise in the assembly and integration of nuclear chemical process in glove boxes environment,
- Experience and expertise in the assembly and integration of multi-disciplinary speciality equipment which include electrical, electronic, mechanical components.

## 7 Duration of services

The Contract will be carried out over an initial firm period of three (3) years. The Contract is scheduled to come into force in Q1 -2022.

## 8 Candidature and Eligibility

Participation is open to all legal persons participating either individually or in a grouping (consortium) which is established in an ITER Member State. A legal person cannot participate individually or as a consortium partner in more than one application or tender. 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.

Legal entities belonging to the same legal grouping are allowed to participate separately if they are able to demonstrate independent technical and financial capacities. Candidates (individual or consortium) must comply with the selection criteria. The IO reserves the right to disregard duplicated reference projects and may exclude such legal entities from the pre-qualification procedure.

Only ITER Member States are eligible for tendering, either individually, as part of a consortium or being included as a subcontractor:

- European Union including, provisionally, the UK. UK entities may only be awarded a contract upon the successful ratification of the UK's EURATOM membership before the contract award date, or by exceptional recommendation of the award of contract by the ITER council. Note that Switzerland is no longer a member of EURATOM and cannot be awarded a contract either individually, as part of a consortium or be included as a subcontractor therein.
- Republic of India,
- Japan,
- People's Republic of China,
- Republic of Korea,
- Russian Federation,
- United States of America.

The ITER Organization may decide to broaden the eligibility to other countries as deemed appropriate.

## **9 Reference**

Further information on the ITER Organization procurement can be found at:

<http://www.iter.org/org/team/adm/proc>