
	Design of ITER Component Cooling Water System-2F (CCWS-2F) and Chilled Water System-H4 (CHWS-H4)	GeM Bid No.
		GEM/2025/B/6240925

PART-A (II)

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	Subtitle PART-A(II): Scope of Work and Technical Specifications

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List of abbreviation

BoM	Bill of Materials
BOQ	Bill Of Quantity
CAD	Computer Aided Design
CCWS	Component Cooling Water System
CDR	Conceptual Design Review
CHWS	Chilled Water System
CODAC	Control, Data Access and Communication
CWS	Cooling Water System
DB	Distribution Board
DCM	Design Compliance Metrix
ECH & CD	Electron Cyclotron Heating & Current Drive
EDH	Electrical Design Handbook
EP	Embedded Plates
FRS	Floor Response Spectra
GA	General Arrangement
HRS	Heat Rejection System
HVAC	Heating, Ventilation and Air Conditioning
HVPS	High Voltage Power Supply
I&C	Instrumentation and Control
ICD	Interface Control Document
IDM	ITER Document Management (System)
INDUS	ITER-India Document Management System
IS	Interface Sheet
ITER-India	Indian Domestic Agency
ITER-IO	ITER International Organization
JB	Junction Board
LCP	Local Control Panel
LCS	Local Control System
LTM	Long Term Maintenance
LV	Low Voltage
MCC	Motor Control Centre
MIP	Manufacturing Inspection Plan
MV	Medium Voltage
NSC	Non Seismic Class
OEM	Original Equipment Manufacturer
P&ID	Piping and Instrumentation Diagram

PBS	Plant Breakdown Structure
PCDH	Plant Control Design Handbook
PCS	Plant Control System
PED	Pressure Equipment Directive
PFD	Process Flow Diagram
PHE	Plate type Heat Exchanger
PIS	Plant Interlock System
PLC	Programmable Logic Control
PMS	Piping Material Specification
POS	Plasma Operation State
PSS	Plant Safety System
QC	Quality Class
QP	Quality Plan
SIC	Safety Important Component
SLD	Single Line Diagram
SRD	System Requirement Document
SSD	See System Design
STM	Short Term Maintenance
TCS	Test and Conditioning State
TCWS	Tokamak Cooling Water System
TL	Transmission Line
VFD	Variable Frequency Drive
VSS	Valve Specification Sheet
WPU	Water Polishing Unit

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1 Preamble

- 1.1 This Part A (II) contains the Scope of Work and Technical Specifications applicable to this tender. The general terms and conditions of contract (Part A-III), eligibility criteria & instructions to bidders (Part A-I) and this Part A-II including the Annexes hereto will become integral part of tender and are complementary to each other and shall be read in conjunction with each other. These are the documents are to be read and understood by the bidder before submitting the bids.
- 1.2 In case of conflicting requirements specified in various parts and annexes of the tender, either the stringent one or the requirement as per the Purchaser's interpretation shall govern.
- 1.3 All the rights, discretion and powers of the Purchaser under the Contract shall be exercised by the Purchaser through written communications, which shall be given by the authorized representative of the Purchaser.
- 1.4 ITER-India, by this tender, is in the process of seeking design and engineering consultancy from reputed engineering design consultants to carry out the complete design of CCWS-2F and CHWS-H4. ITER-India also wishes to get consultancy services in the preparation of technical specifications for tender document, which shall be floated later as tender for "detailed design, engineering and procurement of ITER CCWS-2F and CHWS-H4".

2 Introduction


2.1 Overview of ITER Project

The objective of ITER is to demonstrate the scientific and technological feasibility of fusion energy for peaceful purposes. As one of the few options for large-scale, non-carbon future supply of energy, fusion has the potential to make an important contribution to sustainable energy supplies. Fusion can deliver safe and environmentally benign energy, using abundant and widely available fuel, without the production of greenhouse gases or long-term nuclear waste. Realizing fusion's potential as technically challenging, the major world powers have decided to work together to take the next step towards producing fusion energy.

ITER is being constructed at St. Paul lez Durance, Cadarache, France. The seven ITER members (referred as the Domestic Agencies [DA]) are China, European Union (host country), India, Japan, South Korea, Russia and United States of America. ITER International Organization (ITER-IO), comprising engineers and scientists from all the DAs has been formed to co-ordinate and integrate the activities and is based at Cadarache.

More information on ITER project can be obtained on the website <http://www.iter.org>.

As an ITER partner, Indian Domestic Agency (termed as ITER-India) is responsible for approximately 9% of the construction cost of ITER. During construction, India will contribute hardware components, personnel and cash. The Indian scope of the project is being accomplished through collaboration of Institute for Plasma Research, an autonomous institute under Department of Atomic Energy (DAE), Government of India.

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2.2 ITER Cooling Water System

The success of ITER is highly dependent on the effective removal of excess heat from the ITER machine during all stages of Tokamak operations along with the heat removal from the supporting systems. This objective will be accomplished by the Cooling Water System (CWS). The overall Cooling Water System (CWS) of ITER machine is divided into the following subsystems.

- Tokamak Cooling Water System (TCWS)
- Component Cooling Water System (CCWS)
- Chilled Water System (CHWS)
- Heat Rejection System (HRS)

TCWS is essentially the primary heat transfer system of ITER machine and it is not relevant for the scope of works in this contract. The relationship in terms of heat flow path among the above stated systems CCWS, CHWS and HRS and their subsystems are shown in Figure 2-1 below. The scope of this contract is limited to the subsystems CCWS-2F and CHWS-H4 as highlighted with grey background in the figure.

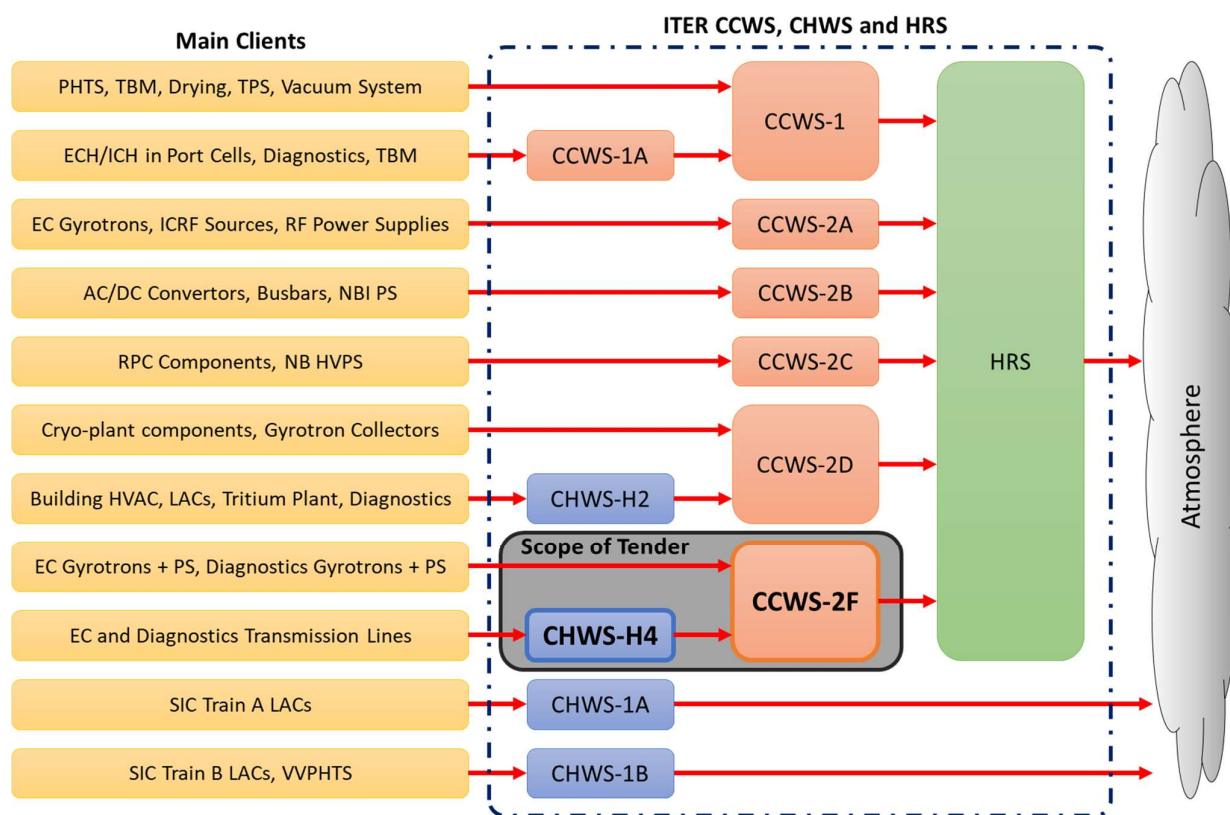



Figure 2-1: Heat transfer among systems of ITER CWS

All the sub-systems are bonded together through heat transfer. In Figure, for instance, client PHTS transfers heat to CCWS-1 and CCWS-1 then transfers the heat to HRS. Similarly, heat transfer takes place from other clients also as indicated by the direction of arrow.

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Among these systems, CCWS is provided to transfer the heat from the clients to HRS. CCWS is further divided into CCWS-1, CCWS-1A, CCWS-2A, CCWS-2B, CCWS-2C, CCWS-2D and CCWS-2F. CCWS-1 is to remove heat received from ITER PHTS.

CHWS-H1 utilizes Air Cooled chillers to reject the heat to the environment. CHWS-H2 transfers the heat to CCWS-2D and CHWS-H4 transfers the heat to CCWS-2F through water cooled chillers and finally heat is rejected to atmosphere through HRS.

Among the above cooling water systems, IN-DA have successfully delivered the Component Cooling Water Systems (CCWS-1, CCWS-2A, CCWS-2B, CCWS-2D), Chilled Water System (CHWS-H2) and Heat Rejection System (HRS) to ITER facility at Cadarache (France). The supplied systems have been commissioned and are under partial operation to support the commissioning of ITER cryoplant.


Recently, an additional heat load is introduced to the ITER Cooling Water System in the new updates of ITER project. To address this increased demand, two new closed-loop systems CCWS-2F (100 MW) and CHWS-H4 (5.6 MW) are added in Cooling Water System. In this regard, with the conceptual design as the basis, ITER-India plans to award contract to a design and engineering consultant to carry out the design and engineering of the CCWS-2F and CHWS-H4. The conceptual / basic design of the CCWS-2F and CHWS-H4 systems has been completed.

2.3 ITER project site

ITER project site is located at the north-east of the existing CEA campus at Cadarache, which is at 43° 41' 15" N, 5° 45' 43" E, and is about 60 km north-east from Marseille. The Cadarache site is situated 40 km north of the city of Aix-en-Provence in the Provence-Alpes-Cote d'Azur region of the France. The meteorological data of ITER site are given below.

Table 2-1: Meteorological data of ITER site

Elevation above mean sea level		315 m
Ambient Air Temperatures	Maximum Dry Bulb Temperature	45°C
	Minimum DBT	-25°C
Relative humidity	Mean annual	80%
	Maximum during monsoon	95%
Rain fall	Annual rainfall	965 mm
	Maximum intensity for one hr	120 mm
	Max. Intensity sustained for 24 hrs	180 mm
Seismology	Site falls in seismic zone – 4 as per seismic zoning map of France, French decree/order/circular 22 of October 2010	
Wind Speed (Max.)		105 km/hr
Maximum snowfall (within 24 hours)		230 mm

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3 Operating Scenarios

This section includes the scenarios and states of ITER operation and operation modes of cooling water systems. Further details for operation scenarios and states shall be provided while designing of the cooling water system.

3.1 ITER Operation Scenarios

ITER machine is a “Pulse-operating machine” and is designed to meet the requirements of the three DT reference plasma scenarios during the lifetime. Table 3-1 shows the operating cycle durations of these scenarios.

Table 3-1: Operation Scenarios of ITER

Scenario →	Inductive Operation	Hybrid Operation	Non-Inductive Operation
Pulse operation	500 sec	1000 sec	3000 sec
Dwell period	1300 sec	3000 sec	9000 sec
Cycle Time (Repetition time between pulses)	1800 sec	4000 sec	12000 sec
Number of Cycles	480 cycles (10 days continuous operation)		


All ITER systems shall be designed to perform the Inductive reference scenario. The Hybrid and Non-inductive scenarios shall be achievable within the design requirements of the inductive scenario, excepting additional investments for auxiliary systems upgrades.

3.2 ITER Operation States

Table shows the pre-defined operating states of ITER machine and the corresponding states of CCWS-2F and CHWS-H4.

Table 3-2: Operation states of ITER machine

ITER Operation States	Remark	CCWS-2F Operation State	CHWS-H4 Operation State
Plasma Operation State (POS)	Day period (2 x 8 h or 3 x 8 h) during which ITER is operated for Plasma physics.	Normal operation at full capacity	Normal operation at full capacity
Test and Conditioning State (TCS)	Conditioning of the Vacuum Vessel	Operational at Full / Partial load	Operational at Full or Partial load
Short Term Maintenance (STM)	Stopping of the ITER plasma operations for short break (8h silent shift) or few days routine maintenance (< 30 days.)	Operational at Partial Load	Operational at Partial Load

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Long Term Maintenance (LTM)	Stopping of the plasma operations for a long period (>30 days) for maintenance or upgrade of the systems.	Operation at partial capacity to support any client testing requirements	Intermittent Operation at partial capacity to fulfil any client testing requirements
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3.3 Operating Modes of Cooling Water System

Cooling water system will have three operating modes as mentioned below.

- Mode 1: Cooling Mode

Cooling water system will operate with full or partial capacity to support the POS, TCS and STM/LTM depending on the ITER Machine Status.

- Mode 2: Off Mode

In Off Mode there is no flowrate and no heat transfer, the system or components are in its de-energized state or under shutdown.

- Mode 3: Maintenance Mode

This mode corresponds to system status for equipment maintenance characterized by standard maintenance programs laid by the equipment manufacturer.

4 System Description

System description includes process design, configuration, arrangement and interfaces of CCWS-2F and CHWS-H4 as per conceptual design. It is to be noted that the description in this section is to provide overview of the systems to bidder who is expected, through this contract, to finalize process design, configuration and layout while respecting interfaces, requirements from various clients and constraints.

4.1 System Classifications

Applicable classification of systems according to the rules defined by ITER for safety (ITER_D_347SF3), seismic (see ITER_D_2DRVPE) and quality (see ITER_D_24VQES) requirements are mentioned in the table below.

Table 4-1: System Classifications

System	Safety Class	Seismic Class	Quality Class
CCWS-2F (PBS 26.CC.2F)	Non-SIC	NSC	QC-2
CHWS-H4 (PBS 26.CH.H4)	Non-SIC	NSC	QC-2

4.2 Applicable Codes and Standards

Codes and standards defined for ITER mechanical components (ITER_D_25EW4K) are applicable to CCWS-2F and CHWS-H4. Codes and standards used for buildings (ITER_D_25EW4K) are

applicable for design of structural supports and attachments while EDH Part 3 (ITER_D_2E8DLM) is applicable for electrical equipment of CCWS-2F and CHWS-H4. CE Marking Directives adopted by the European Union, French regulations related to Occupational Health and Safety, applicable French Decrees and French Environmental Code are also applicable to the design of CCWS-2F and CHWS-H4. Important, but not all, codes, standards and directives from these references applicable to CCWS-2F and CHWS-H4 are listed below.

- ASME B31.3 – Process Piping
- ASME BPVC Section VIII Div. 1 - Rules for Construction of Pressure Vessels
- Eurocode 1 - Basis of structural design
- Eurocode 1 - Actions on structures
- Eurocode 3 - Design of steel structures
- Eurocode 8 - Design of structures for earthquake resistance
- ASME B16.25 - Buttwelding Ends
- ASME B16.5 - Pipe Flanges and Flanged Fittings
- ASME B16.47 - Large Diameter Steel Flanges: NPS 26 through NPS 60
- ASME B16.9 - Factory-Made Wrought Buttwelding Fittings
- ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves
- ASME B16.20 – Metallic Gaskets for Pipe Flanges
- ASME B36.10 - Welded and Seamless Wrought Steel Pipe
- ASME B36.19 - Stainless Steel Pipe
- HIS - Hydraulic Institute Standards for Rotodynamic Pumps
- API 610 - Centrifugal Pumps for Petroleum, Petrochemical, and Natural Gas Industries
- API 662-1 - Plate Heat Exchangers for General Refinery Services - Part 1 - Plate-and-Frame Heat Exchangers
- API 662-2 - Plate Heat Exchangers for General Refinery Services - Part 2 – Brazed Aluminum Plate-fin Heat Exchangers
- EJMA – Standards of the Expansion Joint Manufacturers Association
- ASME B16.34 - Valves – Flanged, Threaded, and Welding End
- API 520 - Sizing, Selection, and Installation of Pressure-relieving Devices
- API 521 - Pressure-relieving and Depressuring Systems
- ISO 14122 – Safety of machinery – Permanent means of access to machines
- ASME BPVC Section V - Nondestructive Examination
- ASME BPVC Section IX - Welding, Brazing, and Fusing Qualifications
- ASHRAE 15 - Safety Standard Refrigeration Systems
- ASME QME-1 - Qualification of Active Mechanical Equipment Used in Nuclear Power Plants
- IEC 60439 - Low-Voltage switchgear and control gear assemblies
- IEC 60947 – Low voltage switchgear and control gear
- IEC 60034 – Rotating electrical machines
- NF C13-200 – High Voltage Electrical Installations – Requirements
- NF C15-100 – Low Voltage Electrical Installations
- IEC 60529 – Degrees of protection provided by enclosures

- Directive 2014/68/EU – Pressure Equipment Directive
- Directive 2006/42/EC – Machinery Directive
- Directive 2014/35/EU – Low Voltage Directive
- Directive 2014/30/EU – EMC Directive
- European Directive 2004/40/CE
- French Labour Code – Health and safety at work
- French Environmental Code Article R557 and L557

4.3 Design and Configuration of CCWS-2F

CCWS-2F is a dedicated loop to cool down the additional heat load from PBS 52 (56 Gyrotrons, Collectors and associated HVPSs) and PBS 55 (1 Gyrotron, Collectors and associated HVPSs). CCWS-2F also serves condenser of CHWS-H4 chillers and PHE of CHWS-H4. CCWS-2F transfer the received heat to HRS through the PHE located in level-2 of building 63. Supply temperature of cooling water is at 31 °C except cryo compressors which requires at 28 °C. Total heat load capacity of CCWS-2F is 100 MW and circulating water flow rate is 2860 kg/sec. Loop volume of the CCWS-2F is 1050 m³. Heat loads and flow rates of CCWS-2F in different scenarios will be detailed during design of system. Figure 4-1 shows the schematic of CCWS-2F.

CCWS-2F consists mainly of:

- 4 Horizontal Centrifugal Pumps – 3 working and one in stand-by, each with a capacity of 4120 m³/hr. Main pumps are equipped with drive motor and VFD. Each Pump is equipped with a strainer at the suction and check valve at the discharge.
- 4 Plate Heat Exchangers, each with a capacity of 25 MW, to release the heat load in HRS.
- A nitrogen Pressurizer with 10 m³ volume to keep the water pressurized, to accommodate fluid expansion during different operating scenario of the system and maintain sufficient NPSH for the system pumps.
- CCWS-2F needs to cool down also CHWS-H4 chillers, hence, there are 5 connections provided for the chiller condensers and its oil coolers.
- A Water Polishing Unit (WPU) with two streams (One stream working + one stand by), total capacity of 246 m³/hr per Unit (123 m³/hr per stream), to maintain the desired water quality of circulating water.
- 2 sets of Booster Pumps with capacity of 122.3 m³/hr and 168.1 m³/hr, needed to recover the pressure from the return of PBS-52 and PBS-55 systems requiring low operating pressure (< 1 bar g). Each set have 1 working and 1 stand by pumps.
- Approx. 57 compact brazed plate heat exchangers with maximum capacity of 3 kW, in correspondence of PBS-52 and PBS-55 Cryocompressors, requiring a maximum cooling water of 28 °C.
- Piping (approx. 3.5 km running length with diameters from DN15 to DN1200) and Valves (approx. 714 nos - control valves, check valves, on-off, pressure relieving, vacuum breaker etc.).

- Electrical (MCCs, LCPs, DBs, etc..) and Instruments components (RIO Cubicles, I&C JBs, Instruments, etc..)
- Heat Tracing system and thermal insulation, as required

As far as the system arrangement is concerned, main components of CCWS-2F such as Pumps, Pressurizer and Heat Exchangers will be installed in the new Building 63, while the clients will be located in the new building 18 and in the north side of building 15. Figure 4-2 shows the overall arrangement of CCWS-2F components.

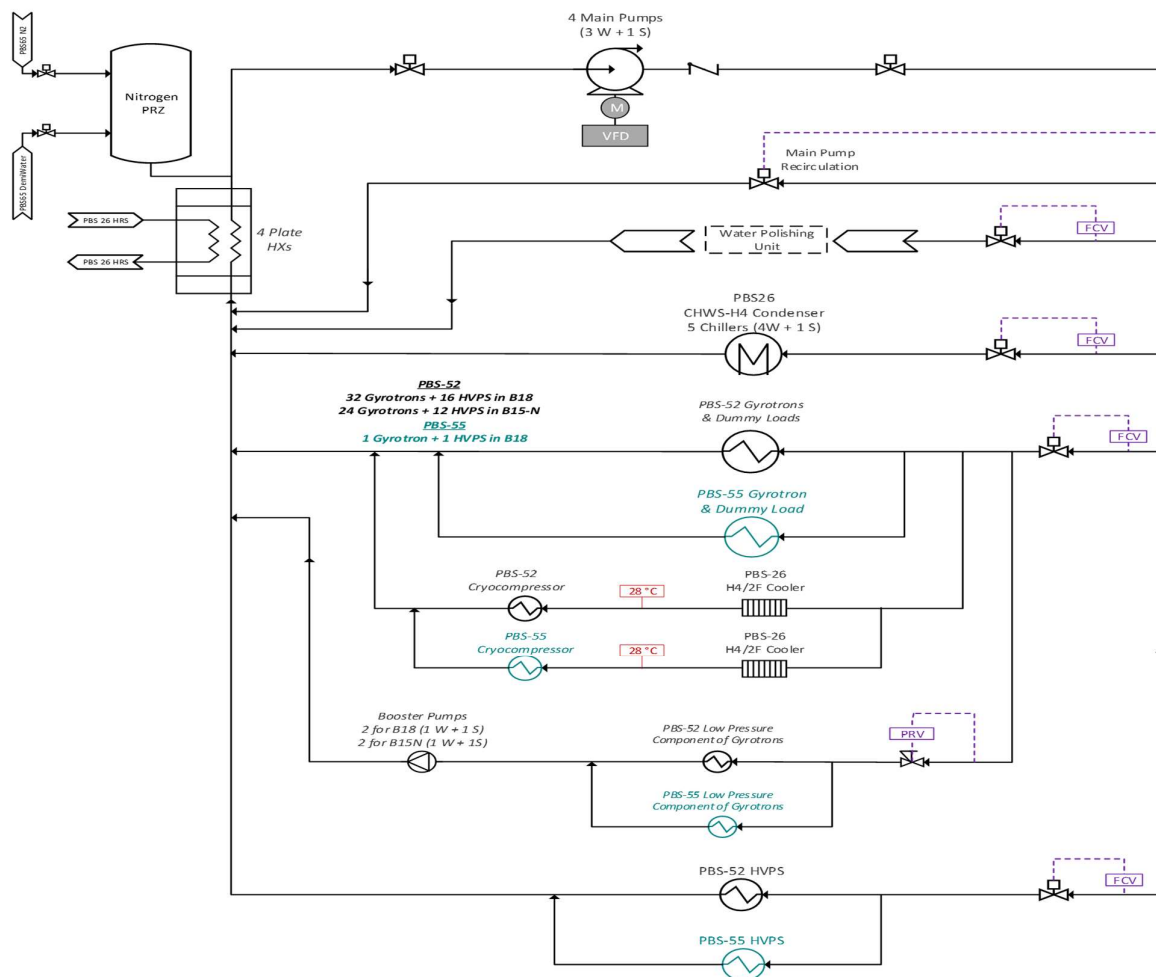


Figure 4-1: Schematic of CCWS-2F

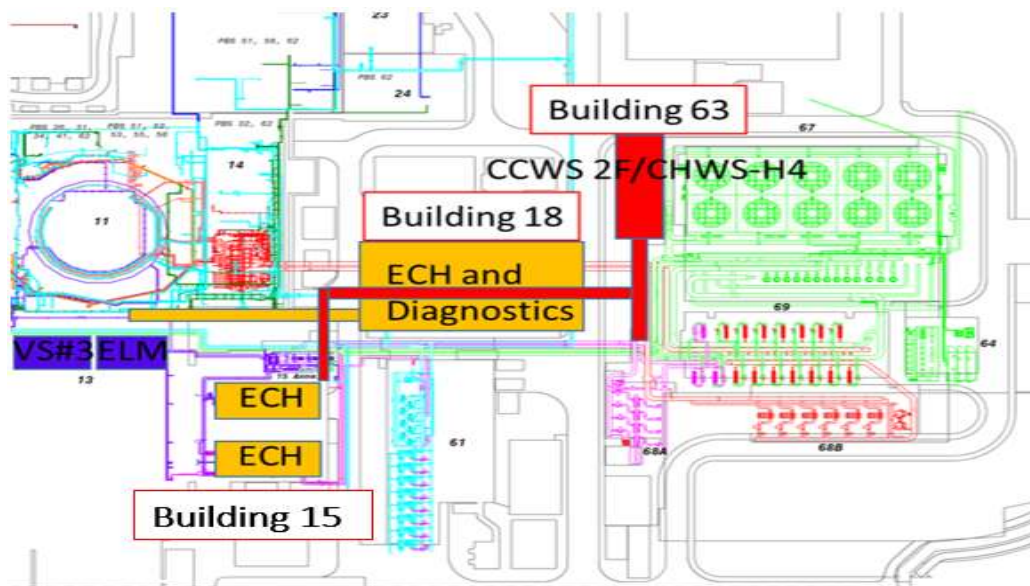


Figure 4-2: Arrangement of CCWS-2F

4.3.1 Circulating Water Quality of CCWS-2F

Required circulating water quality of CCWS-2F is in Table 4-1.

Table 4-2: Water Quality of CCWS-2F

Parameter	CCWS-2F Circulating Water Quality
Conductivity @ 25°C ($\mu\text{S}/\text{cm}$)	1
pH (given $T = 25^\circ\text{C}$)	6.5 – 7.5
Chloride, ppb	≤ 10
Iron, ppb	≤ 10
Silica, ppb	≤ 200
Dissolved oxygen, ppb	≤ 50
TOC, ppb	≤ 100

4.3.2 Interface Requirements of CCWS-2F

CCWS-2F have interface with PBS 52, PBS 55, CHWS-H4, HRS and utilities / buildings. Interfaces listed here are of functional interfaces. Updated client's functional requirements and individual tapping's physical interface locations shall be provided at the time of design.

Note: Requirements mentioned in Interface Sheets of respective clients shall be governing.

4.3.2.1 CCWS-2F (PBS26) and ECH & CD (PBS52)

CCWS-2F provides cooling water to PBS 52 (ECH & CD system) components listed below:

- Gyrotrons Manifolds (including gyrotrons' collectors and dummy loads)– In total of 56 interfaces.
- HVPS - In total 28 interfaces.
- Cryo compressors – In total 56 interfaces.
- Low pressure manifold of the gyrotrons – In total 56 interfaces.


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Table 4-2 and Table 4-3 summarized the requirements of PBS 52.

Table 4-3: Requirements of PBS-52 Clients in Building 18

Parameter	Gyr. Main Manifold	HVPSs	Cryo Compres.	Gyr Low Pressure Manifold	Total
<i>Heat Load Requirement [MW]</i>	48	0.58	0.23	0.76	49.6
<i>Flow Rate [kg/s]</i>	1306	20	4.7	36	1366.7
<i>Coolant Inlet Temperature [°C]</i>	28±3	28±3	4 to 28	28±3	-
<i>Coolant Outlet Temperature [°C]</i>	39 ± 1	35± 2	39± 2	35± 2	-
<i>Coolant Inlet Pressure [MPa(g)]</i>	0.85 ± 0.2	0.75 ± 0.1	0.85 ± 0.2	0.85 ± 0.2	-
<i>Client Total Pressure Drops [MPa]</i>	0.65	0.55	0.3	0.5	-

Table 4-4: Requirements of PBS-52 Clients in Building 15


Parameter	Gyr. Main Manifold	HVPSs	C.Compres.	Gyr Low Pressure Manifold	Total
<i>Heat Laod Requirement [MW]</i>	36	0.45	0.18	0.56	37
<i>Flow Rate [kg/s]</i>	980	15	3.5	27	1026
<i>Coolant Inlet Temperature [°C]</i>	28±3	28±3	4 to 28	28±3	-
<i>Coolant Outlet Temperature [°C]</i>	39 ± 1	35± 2	39± 2	35± 2	-
<i>Coolant Inlet Pressure [MPa(g)]</i>	0.85 ± 0.2	0.75 ± 0.1	0.85 ± 0.2	0.85 ± 0.2	-
<i>Client Total Pressure Drops [MPa]</i>	0.65	0.55	0.3	0.5	-

4.3.2.2 CCWS-2F (PBS26) and Diagnostics (PBS55)

CCWS-2F provide cooling water to an additional gyrotron and its subcomponents in the scope of PBS-55. Table 4-4 summarized requirements of PBS 55.

Table 4-5: Requirements of PBS-55 Clients in Building 18

Parameter	Gyr. Main Manifold	HVPSs	Cryo compressors	Gyr. Low Pressure Manifold	Total
<i>Heat Load Requirement [MW]</i>	3.4	0.05	0.0072	0.0235	3.5
<i>Flow Rate [kg/s]</i>	65	0.8	0.15	1.13	67.1
<i>Coolant Inlet Temperature [°C]</i>	28±3	28±3	4 to 28	28±3	-
<i>Coolant Outlet Temperature [°C]</i>	39 ± 1	42± 2	39± 2	35± 2	-

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<i>Coolant Inlet Pressure [MPa(g)]</i>	0.85 ± 0.2	0.75 ± 0.1	0.85 ± 0.2	0.85 ± 0.2	-
<i>Client Total Pressure Drops [MPa]</i>	0.65	0.55	0.3	0.5	-

4.3.2.3 CCWS-2F (PBS26) and CHWS-H4 (PBS26)

CCWS-2F and CHWS-H4 have three interfaces as briefed below;

1. CCWS-2F provide cooling water to 4 Chiller's condensers and oil coolers of CHWS-H4.
2. CHWS-H4 cools the cooling water supply temperature of CCWS-2F from 31 °C to 28 °C through 57 compact brazed plate heat exchangers for the cryo-compressors.
3. CCWS-2F will heat up CHWS-H4's chilled water supply temperature to 22 °C during dwell period through Plate Heat Exchanger. During dwell period, the CHWS-H4 will by-pass the chilled water coming from the Chillers from this heat exchanger in order to maintain constant outlet temperature of 22°C.

Table 4-5 shows the heat load and flow rate of interfaces.

Table 4-6: Interfaces between CCWS-2F and CHWS-H4


Parameter	CHWS-H4 Condenser	PHE on Cryocompressor Line
Heat Load Requirement [MW]	8	0.0032
Flow Rate [kg/s]	600	0.15
Coolant Outlet Temperature [°C]	37 ± 1	26 ± 2
Coolant Inlet Pressure [MPa(g)]	0.45 ± 0.1	0.7 ± 0.1
Client Total Pressure Drops [MPa]	0.2± 0.05	0.2± 0.05

4.3.2.4 CCWS-2F (PBS26) and HRS (PBS26)

HRS will provide cooling water to CCWS-2F PHE located in building 63. CCWS-2F Thermal-Hydraulic parameters associated to PHE with HRS are resumed in Table 4-6.

Table 4-7: Interface between CCWS-2F and HRS

Thermal-Hydraulic Parameter	PHE
Heat Load Requirement per HX [MW]	25
Flow Rate Primary Side [kg/s]	720
Flow Rate Secondary Side [kg/s]	700
Coolant Outlet Temperature [°C]	38±1 / 31
Coolant Inlet Pressure [MPa(g)]	0.15
PHE Total Pressure Drops [MPa]	0.1 ± 0.05

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4.3.2.5 Utilities and other Interfaces

PBS 65 will provide nitrogen and make up water (DM) to CCWS-2F.

PBS 63, 62 shall provide building with adequate space for CCWS-2F components and piping. Building shall include in their scope the plinths for equipment, embedded plates for support fixings and/or any crane/monorail with suitable laydown area for equipment handling during repair/maintenance.

PBS 63 shall provide services drain points inside building to facilitate draining of CCWS-2F.

PBS 61 shall provide foundations, trenches, bridges for pipework falling outside in between different buildings. PBS 61 shall also facilitate system draining from low points falling outside of building.

All CCWS-2F MV and LV electrical power including grounding needs shall be met by the PBS 43 Steady State Electrical Network

PBS 44 cable trays and support for CCWS-2F's medium and low voltage power, site earth grid and earthing, instrumentation, controls, and communications cables.

High-level control commands required for CCWS-2F operation are provided by PBS 45 CODAC. The CCWS-2F shall include a Local Control System (LCS) capable of operating the CCWS-2F based on the high-level control commands provided by CODAC. The CCWS provides system state and performance data required by CODAC for plant operation.

4.4 Description of CHWS-H4

CHWS-H4 is closed chilled water loop to remove the heat load from the new transmission lines of PBS 52 and 55. CHWS-H4 also lowers the supply temperature of CCWS-2F connections serving to Cryo Compressor. CHWS-H4 supply temperature is 22 °C and the temperature stability of the supply temperature is required to be within ± 1 °C. Total heat load capacity of CHWS-H4 is 5.62 MW and circulating chilled water flow rate is 310 kg/sec. Loop volume of the CHWS-H4 is 150 m³.

The heat load from the Transmission Lines is cyclic in nature. In one of the ITER Operation scenario, one heat load cycle is of 1800 seconds and it will continue to repeat. Heat load variation in one cycle is as below. Heat loads and flow rates of CHWS-H4 during different scenarios will be detailed further during design.

- For 500 seconds, client's heat load is 5.6 MW
- Next 1300 second, no heat load or near to zero

Figure 4-3 is the chart of heat load vs time. Two cycles are shown in chart, but operation will continue for three shifts.

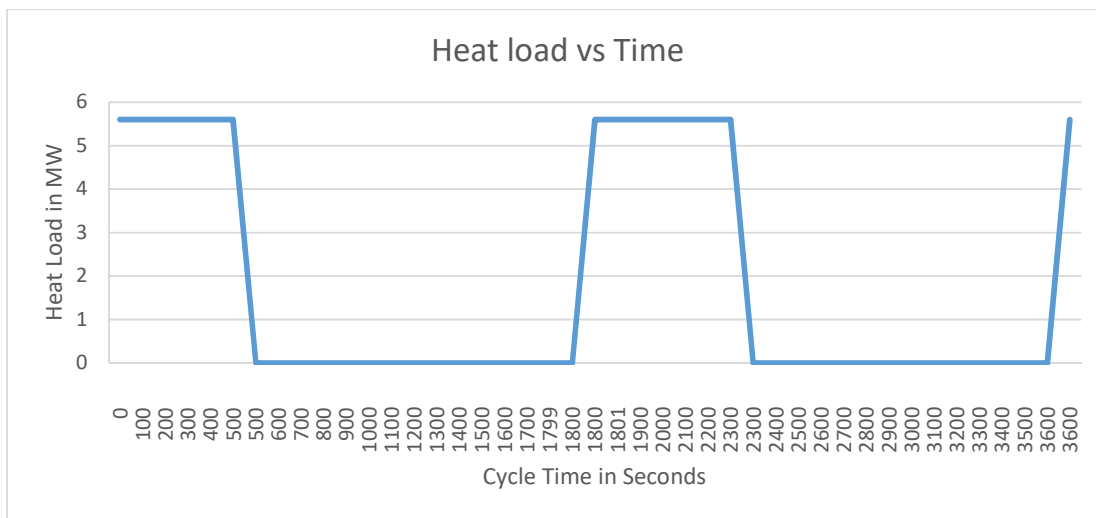


Figure 4-3: CHWS-H4 Heat load vs Time

Therefore, design provisions of CHWS-H4 are required to keep the loop temperature stable around 22 °C during plasma pulse and dwell period. Since it is not possible for the big equipment like chillers to precisely follow the heat load input to the system, it is necessary to find other means to stabilize the loop temperature. Hence a temperature control HX is selected to stabilize the loop temperature by creating heat input for the loop during the dwell phase. This temperature control HX maintain the supply temperature during the dwell period by extracting the heat from the CCWS-2F. In this way, CCWS-2F is simulating the client heat load during the dwell phase. To account for the delay in the temperature sensing and control valve action, an accumulator tank has also been provided. This accumulator tank allows sufficient time for the control system to be able to valve in and valve out the HX from the loop. Figure 4-4 provides a simplified process flow diagram of the CHWS-H4.

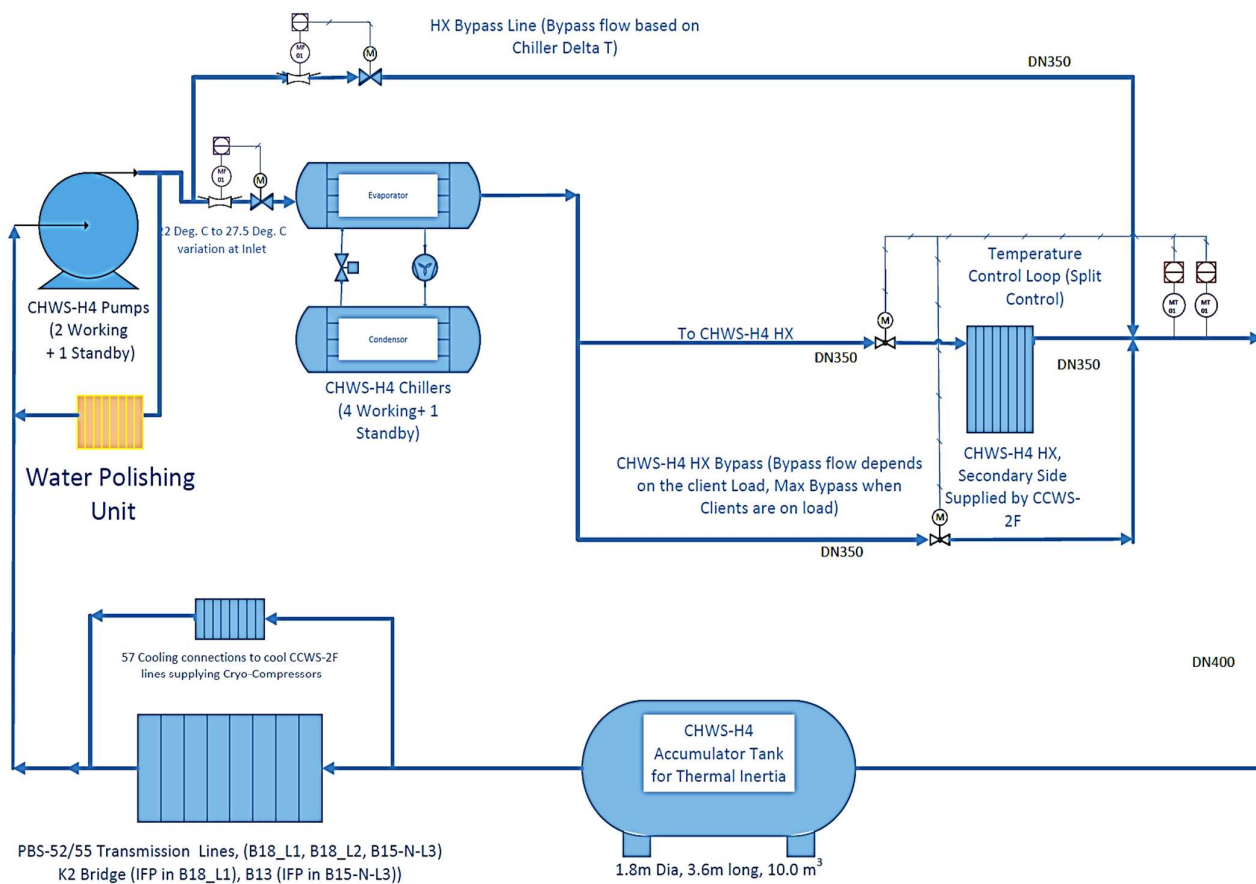


Figure 4-4: Schematic of CHWS-H4

CHWS-H4 consist mainly of:

- 3 horizontal centrifugal pumps: 2 Working + 1 Standby, each with a capacity of 564 m³/hr. Pumps are equipped with drive motor and VFD. Each Pump is equipped with a strainer at the suction and check valve at the discharge.
- Water cooled Chillers: 4 Working + 1 Standby, each with a capacity of 1.5 MWth.
- A Plate Type Heat exchanger, with capacity of 5.7 MW, to add heat from CCWS-2F to simulate the client load when clients are not on full load.
- A Water Polishing Unit (WPU) with two streams (One stream working + one stand by), total capacity of 20 m³/hr per Unit (10 m³/hr per stream), to maintain the desired water quality of circulating water.
- Accumulator Tank with 10 m³ capacity, to dampen the temperature response of the loop
- Piping (approx. 3.2 km running length, diameters from DN 15 to DN400) and Valves (approx. 320 nos - control valves, check valves, on-off, pressure relieving, vacuum breaker etc.).
- Electrical (MCCs, LCPs, DBs, etc..) and Instruments components (RIO Cubicles, I&C JBs, Instruments, etc..)

- Heat Tracing system and thermal insulation (NBR), as required

Main process equipment of CHWS-H4 are located in the Building 63. In Building 18, the loop supplies 16 Transmission line in 18-L2 and 17 (16 PBS-52+ 1 PBS-55) in B18-L1. An interface is provided in B18-L1 at close proximity to the starting pint of K2 Bridge to supply water to K2 Bridge Transmission Lines. The CHWS-H4 supply line entering B15-N L3, splits into two branches, one branch supplying the TL in B15- N-L3 and other branch reaches close to B13 Wall, where it provides interface for cooling water supply to the Transmission lines in B13 North and East Walls.

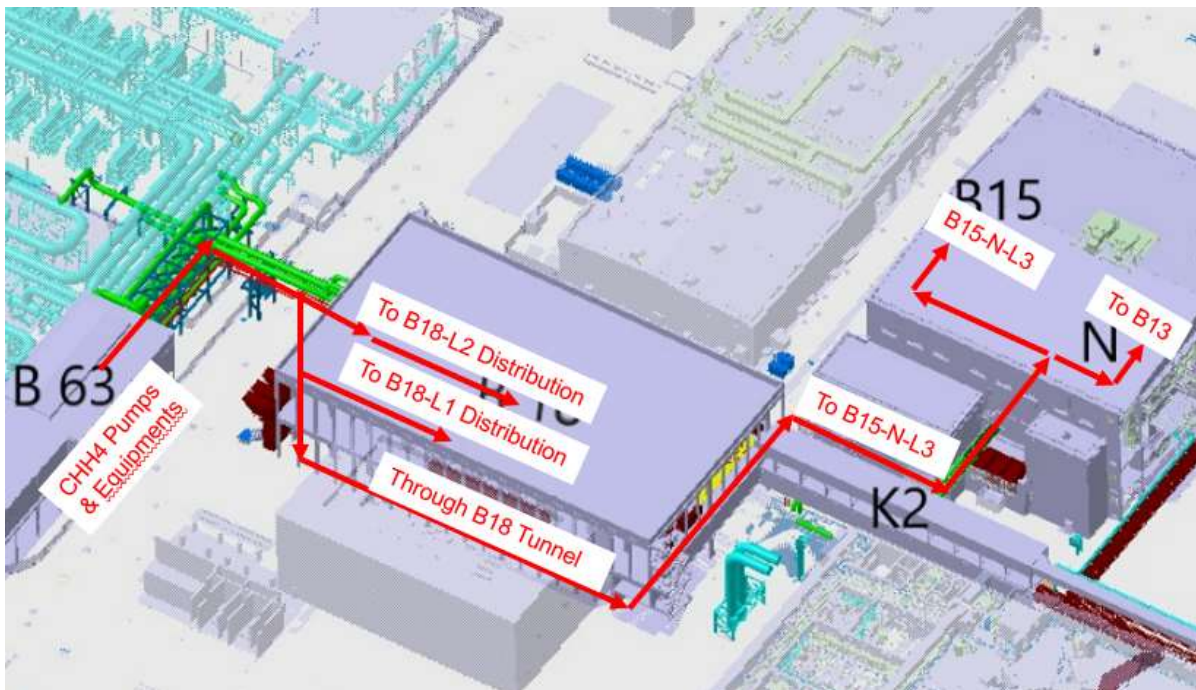


Figure 4-5: Arrangement of CHWS-H4


4.4.1 Circulating Water Quality of CHWS-H4

Required circulating water quality of CHWS-H4 is in Table 4-7.

Table 4-8: Water Quality of CHWS-H4

Parameter	CHWS-H4 Circulating Water Quality
Conductivity @ 25°C (μS/cm)	≤ 0.2
pH (given T = 25°C)	6.5 – 7.5
Sodium, ppb	≤ 10
Chloride, ppb	≤ 10
Iron, ppb	≤ 10
Copper, ppb	≤ 10
Dissolved oxygen, ppb	≤ 10

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Parameter	Building 18-L1	Bridge K2	Building 13 North Wall	Total
<i>Heat Load [MW]</i>	0.018	0.005	0.017	0.04
<i>Flow Rate [kg/s]</i>	1.83	0.92	1.59	4.34
<i>Cooling Water Supply Temperature [°C]</i>	22± 1	22± 1	22± 1	-
<i>Supply Pressure [MPa(g)]</i>	1.0	1.0	1.0	-
<i>Client Total Pressure Drops [MPa]</i>	0.7	0.7	0.7	-

4.4.2.3 CCWS-2F (PBS26) and CHWS-H4 (PBS26)

Refer section 4.3.2.3.

4.4.2.4 Utilities and other interfaces

PBS 65 will provide nitrogen and make up water (DM) to CHWS-H4.

PBS 63, 62 shall provide building with adequate space for CHWS-H4 components and piping. Building shall include in their scope the plinths for equipment, embedded plates for support fixings and/or any crane/monorail with suitable laydown area for equipment handling during repair/maintenance.

PBS 63 shall provide drain points inside building to facilitate draining of CHWS-H4.

PBS 61 shall provide foundations, trenches, bridges for pipework falling outside in between different building. PBS 61 shall also facilitate system draining from low points falling outside.

All CHWS-H4 electrical power including grounding needs shall be met by the PBS 43 Steady State Electrical Network

PBS 44 cable trays and support for CHWS-H4's medium and low voltage power, site earth grid and earthing, instrumentation, controls, and communications cables.

High-level control commands required for CHWS-H4 operation are provided by PBS 45 CODAC. The CHWS-H4 shall include a Local Control System (LCS) capable of operating the CHWS-H4 based on the high-level control commands provided by CODAC. The CHWS-H4 provides system state and performance data required by CODAC for plant operation.

4.5 Layout of CCWS-2F and CHWS-H4

Main equipment of CCWS-2F and CHWS-H4 are housed in Building 63. Figure 4-7 shows the snap of Conceptual Design 3D model of Building 63. Refer Annexure-D for more snaps of 3D model.

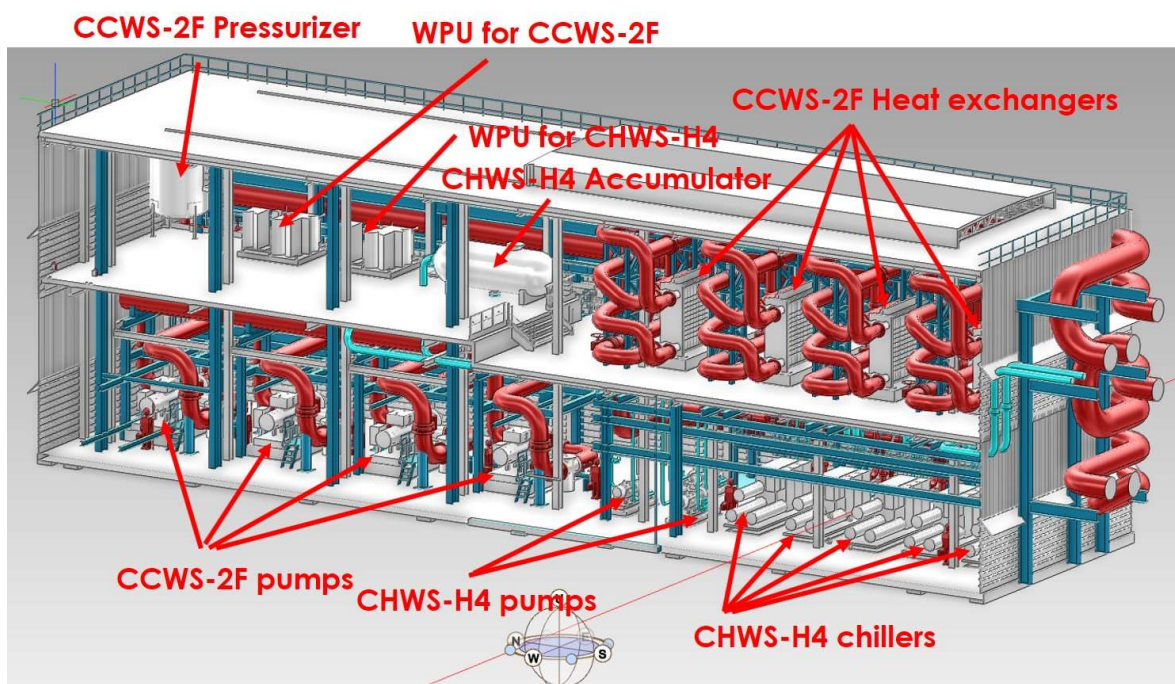


Figure 4-7: Layout of CCWS-2F and CHWS-H4 in Building 63

Distribution piping network of CCWS-2F and CHWS-H4 is spread in Building 18, Building 15 north and transmission line bridge K2. Figure 4-8 shows the snap of piping routing to different buildings below.

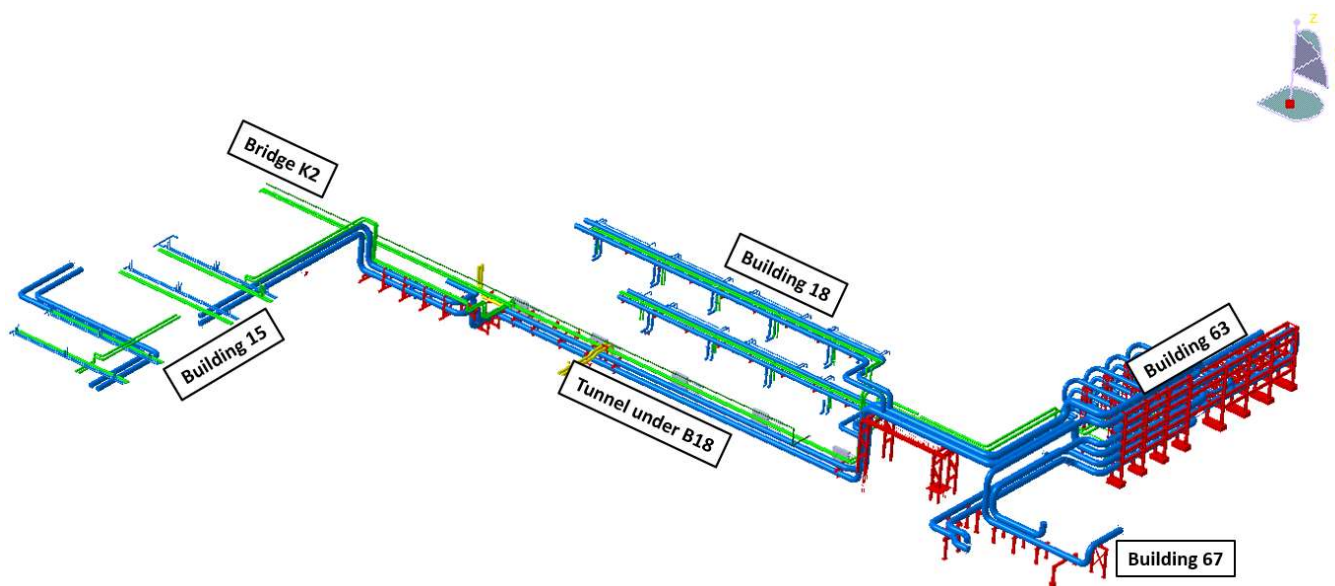



Figure 4-8: Piping Routing of CCWS-2F and CHWS-H4

4.6 Conceptual Design Package of CCWS-2F and CHWS-H4

Conceptual design of the CCWS-2F and CHWS-H4 was prepared by ITER-IO and Conceptual Design Review (CDR) was conducted in June 2024 as per ITER procedure. Design documents,

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piping and instrumentation diagrams, 3D model, hydraulic analysis of systems, drawings etc... were prepared and presented to the CDR committee. List of CDR documents is in Table 11-1. The outcomes of this review are documented in the Panel Report for Conceptual Design Review of PBS26 Cooling Water loops CCWS-2F and CHWS-H4 (AM7SBG v1.0). Summary of the chits (comments) of CDR from Panel Report are in Annexure-C. This CDR package will be the input information for the Bidder to validate and finalize the design and layout of CCWS-2F and CHWS-H4 in all aspects and subsequently to prepare firm technical specifications for procurement and supply of all components to ITER site.

5 Scope of Work

The scope of this tender is mainly divided into two parts:

- 1) Design of ITER CCWS-2F and CHWS-H4
- 2) Preparation of technical specifications for tender of ‘detailed design, engineering and procurement of ITER CCWS-2F and CHWS-H4’.


5.1 Design of ITER CCWS-2F and CHWS-H4

The scope of design consists of mainly carrying out detailed studies/ Analyses of existing conceptual design for feasibility and operability, and of finalization of process parameters i.e. design temperature, pressure, flow rate, system sizing & optimization, preparation/ update of Process Flow Diagrams (PFD), Piping and Instrumentation Drawings (P&ID), selection of system components based on engineering input and vendor catalogues/ interactions, system optimization, preparation of technical data sheets of components and instruments, carrying out piping stress analysis, structural design of primary and secondary supports, interface definitions, update of 3D layout, preparation of piping and equipment layout drawings etc. resulting in a self-consistent, fully documented design reports that shall be submitted to ITER-India. ITER-India (and the third party appointed by ITER-India) shall review the documents. Upon acceptance by ITER-India, the documents shall be submitted to ITER IO for final review and acceptance. The comments/ queries that rise during various review processes need to be resolved by the bidder.

In general, the scope of design is to ‘Perform proper specific analyses to demonstrate that the CCWS-2F and CHWS-H4 meet the design, functional and safety requirements stated in the applicable Input Documents like Interface Sheets, Systems Requirement Documents’. In addition, Design notes / reports to support the selection of schemes / process parameters / equipment/ material/ instrument/ technology etc. need to be prepared and submitted to ITER-India / ITER-IO / Review Committee. All the calculations and analyses carried out to complete the design and prepare the deliverables asked by ITER-India, ITER-IO or Review Committee need to be submitted by the bidder.

Also, all design, operation, installation and maintenance requirements from relevant codes, standards and local rules and regulations shall be incorporated into both the system design and the design/ selection of components/ items.

Note: Updated interface requirements from clients shall be included in the design. Interface / client’s requirements may increase up to 10% of CDR’s interface requirements like total heat load, flowrate and number of connections. Accordingly, provisions need to be kept in the design to accommodate


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such minor changes. Scope of CCWS-2F and CHWS-H4 shall end at the physical interface locations near the clients in respective buildings.

The following is the list of major activities to be carried out as part of the design for CCWS-2F and CHWS-H4.

5.1.1 Design Activities

- 1) Review of conceptual design as described in Section 4, assessing the design adequacy in meeting the requirements and making necessary modifications / improvements in CCWS-2F and CHWS-H4 considering feasibility, operability, maintainability, constructability and commissioning aspects of the systems. Also resolve pending chits from CDR, refer Annexure -C.
- 2) Based on latest functional interface inputs (Heat load and Flow rates) and physical interface inputs (numbers of connections and locations), modifications and also improvements need to be carried out in Conceptual Design of CCWS-2F and CHWS-H4. Necessary reports shall be prepared which includes selection of process parameters and system optimization.
- 3) Review and update PFDs of CCWS-2F and CHWS-H4
PFDs have been prepared for conceptual design of both systems. These PFDs shall be reviewed and updated / prepared as per ITER procedure for latest design inputs data.
- 4) Review and update of P&IDs of CCWS-2F and CHWS-H4
P&ID of CCWS-2F and CHWS-H4 have been prepared in AVEVA Diagram for conceptual design. These P&IDs shall be reviewed and updated based on latest inputs / interfaces and improvements in conceptual design. The control logics (logic notes) also need to be updated along with the P&IDs.
- 5) Review and update / preparation of design calculation reports including system sizing calculations, design conditions calculations, mass balance & temperature variation calculation and system heat loss calculations in each building for respective system.
- 6) Preparation of report for line sizing of CCWS-2F and CHWS-H4.
- 7) Preparation of control valve sizing of CCWS-2F and CHWS-H4.
- 8) Update the steady state hydraulic and thermal analysis of the CCWS-2F and CHWS-H4 for various operation scenarios/ states and prepare detailed report.
Steady state hydraulic and thermal analysis of both systems have been performed in AFT Fathom during CDR. These shall be reviewed and updated based on latest inputs / interfaces and improvements in conceptual design. And incorporate the output in all documents, drawings and 3D model.
- 9) Perform the transient hydraulic and thermal analysis of the CCWS-2F and CHWS-H4 for various operation scenarios/ states and prepare detailed report.
- 10) Review and update pressurizer volume and its pre-charge pressure calculation along with system volume calculation.


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Sizing calculation of pressurizer of CCWS-2F have been performed in CDR. This shall be reviewed and updated according to latest inputs and improvements in conceptual design of CCWS-2F.

- 11) Review and update thermal accumulator design for CHWS-H4

Sizing of thermal accumulator have been performed in CDR. This shall be reviewed and updated according to latest inputs and improvements in conceptual design of CHWS-H4.


- 12) Prepare Pipe thickness calculation for CCWS-2F and CHWS-H4.
- 13) Perform design of overpressure protection devices in CCWS-2F and CHWS-H4s.
- 14) Preparation of Pipe Material Specification (PMS).
- 15) Review and update of 3D models to finalize and improve equipment layout, pipe routing in trenches, tunnel and buildings, pipe support design, constructability and accessibility for operation and maintenance etc. 3D models shall also include any dedicated access platforms, stair, ladders etc. needed for accessing various components for operation and maintenance.
3D model of CCWS-2F and CHWS-H4 have been prepared in AVEVA E3D along with space reservation for components as per CDR. Refer Section 4.3 and Annexure – D. These shall be reviewed and updated based on latest inputs, interfaces, clashes with internal & external systems and improvements in conceptual design of systems. If required, 3D geometry of catalogs for 3D model shall be prepared for components / items.
- 16) Carry out piping stress analysis (including seismic analysis) as per ITER procedure, load specification and guideline.
- 17) Carry out stress analysis (including seismic analysis) of pipe supports including design and verification of joints as per ITER procedure, load specification and guidelines.
- 18) Selection, finalization and/or design of primary supports like pipe straps, shoes, clamps, saddles etc. as per ITER procedures, loads specification and guidelines.
- 19) Selection and finalization of pipe supports, preparation of pipe support drawings showing details of BOQ, joints, welds, bolts, quantities etc., preparation of embedded/ post-drilled part location drawing as per ITER procedure and guidelines.
- 20) Design and verification of anchoring system (embedded plates or post drill plates) for supports.
- 21) Preparation of opening and penetration drawings and equipment pedestal drawings showing requirements for building design.
- 22) Preparation of documents containing all interface data and inputs such as anchor load data (interface loads), fixing location coordinates etc required for respective building's design.
- 23) Carry out constructability, operability and maintainability studies of the both systems and prepare report for each building. And incorporate output of approved reports into the design.
- 24) Prepare 2D drawings including general arrangement (GA) drawings, piping isometric drawings, access platforms and equipment handling systems as required from 3D model. If extraction of some drawings is not possible then those shall be prepared as required.

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- 25) Identification of codes and standards for all equipment and components along with local rules and regulations and include them in design and its respective technical specification, reports and manufacturing and inspection plan.
- 26) Review and update Water Polishing Unit (WPU) design note for both systems.
Design note of water polishing unit for CCWS-2F and CHWS-H4 have been prepared in CDR. This shall be reviewed and updated according to latest inputs and improvements in conceptual design of CCWS-2F and CHWS-H4.
- 27) Identify and design equipment/ components handling system like monorail.
- 28) Identify and design access platforms for component / equipment operation and maintenance in layout following locally applicable rules and regulations.
- 29) Preparation of consolidated requirements of all utilities (like nitrogen gas, compressed air, demineralized water) required for CCWS-2F and CHWS-H4 along with physical location in layout.
- 30) Review and update PED hazard categorization for different equipment and components
PED hazard categorization of piping and equipment for CCWS-2F and CHWS-H4 have been prepared in CDR. This shall be reviewed and updated according to latest inputs and improvements in conceptual design of CCWS-2F and CHWS-H4.
- 31) Review and update the list of equipment, line, instruments and valves for CCWS-2F and CHWS-H4.
- 32) Prepare makeup and drain size calculation for CCWS-2F and CHWS-H4.
- 33) Prepare thermal insulation and heat tracing calculation for CCWS-2F and CHWS-H4.
- 34) Resolution of chits and comments raised during conceptual design review of CCWS-2F and CHWS-H4 and prepare report for the same.
CDR of CCWS-2F and CHWS-H4 was conducted as specified in section 4.4. There may be few outstanding chits (queries) of conceptual design review committee and comments on prepared documents by reviewers. These need to be incorporated in CDR design and documents during contract execution.
- 35) Prepare design compliance matrices (DCM) in the template provided by ITER-India to demonstrate the design performed by contractor meets the requirements of CCWS-2F and CHWS-H4.
- 36) There shall be design review of the systems. A committee shall be formed by ITER-India for the same. Bidder need to present the design to the committee. If any comments and queries raised during the design review, shall be responded by the bidder and applicable comments and queries shall be incorporated in all deliverables. A comments and queries resolution report of design review shall be prepared.

5.1.2 Instrumentation and control (I & C) related activities

- 1) Update/ preparation of Plant system I&C function and architecture.

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Preliminary Plant system architecture have been prepared in CDR. This shall be reviewed and updated according to latest inputs and improvements in conceptual design of CCWS-2F and CHWS-H4. This includes a high level functional analysis (D1A), a detailed functional breakdown with functional links and the characterization of functions (D1B), and the physical and functional architecture (D1C).

2) Update of I&C signals list

Preliminary I&C signal list have been prepared in CDR. This shall be reviewed and updated according to latest inputs and improvements in conceptual design of CCWS-2F and CHWS-H4. All signals connected to the plant system I&C including name, type, sampling rate, allocation to I&C cubicle shall be included in list.

3) Preparation of hardware configuration of I&C cubicles showing the cubicle interfaces with CODAC infrastructure, buildings, power supply and HVAC.

4) Preparation of Instrument Schedule consisting minimum of Instrument Support Stand Schedule, Remote I/O, JB Schedule, etc..

5) Preparation of I/O Database Document consisting minimum of

- I/O naming tags, type and location
- Operating range and Engineering Units of process variables
- Alarm & Tripping set points of process variables, Annunciation Schedule
- Classification of signal with respect to Process Control, Investment Protection & Safety (In other words, Identification of links to PCS, PIS & PSS)

6) Preparation of I&C Cable and tubing schedule document consisting minimum of

- Specification for signalling cable type, tubing, connecting accessories.
- Signal cable connections

7) Preparation of Logic Diagrams for each loop.

8) Review and update of Instrument Hook up drawings consisting minimum of

- Drawings for hook up of each instrument on process lines
- Hook up material requirements


9) Providing inputs for the Interface Sheet to reflect the functional and physical boundary of I&C system. The inputs include interface information such as signal name, type, range, associated component, its location, I/O module etc.

5.1.3 Electrical related activities

1) Update of Electrical Load lists CCWS-2F and power supply requirement list for CCWS-2F and CHWS-H4

Conceptual design electrical load lists and power supply requirements have been developed for both systems. In accordance with ITER practice, this will be evaluated, revised, and prepared according to latest inputs and improvements in conceptual design of CCWS-2F and CHWS-H4..

2) Preparation of Electrical Single Line Diagrams (SLD) using SSD tool.

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Preparation of electrical Single Line Diagrams (SLD) and Schematic Diagrams along with the details like design features, current rating, short circuit rating, current transformers, meters/ instruments, protection with relays fuses, as rating and type of bus-bars, etc. Connected load and power demand on each feeder circuit shall also be indicated.

- 3) Preparation of Preliminary load flow and short circuit analysis report.
- 4) Update the Power and control Cable Schedule document with equipment 3D coordinates document using ITER template

Preliminary power and control cable schedules have been prepared during CDR. This shall be updated as per latest interfaces and improvement in design of CCWS-2F and CHWS-H4.


- 5) Preparation of Cable sizing and selection calculation & Methodology for CCWS-2F and CHWS-H4 as per NFC standards
- 6) Preparation of preliminary Electrical and I&C equipment heat load calculations
- 7) Preparation of Power, Control and Instrument Cabling Diagrams (CBDs) using SSD tool (input from cable schedule).
- 8) Design calculation, electrical load list and control philosophy of electrical heat tracing systems, if required. Also, SLDs and BoM lists of heat tracing items.
- 9) Proposed earthing layout for MV and LV equipment.
- 10) Preparation of drawings to show mounting arrangement of MCCs/Local control panels (LCPs) and DBs for 3D model.
- 11) Preparation of MV and LV motor control philosophy documents.

Existing MV and LV motor control philosophy shall be referred to prepare motor control philosophy for CCWS-2F and CHWS-H4.

- 12) Providing inputs for the Interface Sheet to reflect the functional and physical boundary of Electrical system in between PBS-43 and PBS-44. The inputs include information such as from/to component name, locations, rated power, current, voltage class etc. for interface with PBS43 and information such as cable type, code, from/to component, location etc for interface with PBS44

General Notes:

- 1) The above activities indicate the main activities. There can be some activities (and thus deliverables), which might not have been covered explicitly, but will be required by ITER-India for the completeness and acceptance of the design. The cost of such deliverables is deemed to be included within the scope of this tender.
- 2) All the study / analysis should include fully-documented self-explanatory report prepared using MS Word.
- 3) All the design reports / drawings submitted shall be accompanied by relevant design calculations in appropriate format. Natives files of all calculations, analyses, drawings, diagrams, documents and reports shall be provided.

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5.2 Preparation of Technical Specifications for Tender

The following are the activities to be carried out to support the tender bid document for detailed design, engineering and procurement of ITER CCWS-2F and CHWS-H4.

- 1) Preparation of technical specification and data sheet of all equipment/ items of CCWS-2F and CHWS-H4 like chillers, heat exchangers, pumps, water polishing units, pressurizers/ accumulators, piping, strainers, valves (including VSS), insulation, support structures, primary supports, motors, motor control centres (with protective device), electric distribution panels, VFDs, heat tracing systems, electric power, control and instrument cables, I&C cubicles, actuators, instruments, sensors, cables, etc... as per ITER template.
- 2) Identification of inspection and test requirements along with acceptance criteria and preparation of Manufacturing and Inspection Plan (Quality Assurance Plans) for equipment and other items as per ITER template.
- 3) Preparation of Bill of Quantities for CCWS-2F and CHWS-H4 including equipment, valves, pipe and pipe fittings, insulation, structural steel for supports, primary supports, instruments, actuators, cablings, electric panels, motors, electric items, etc..


5.3 List of Deliverables

The activities carried out by the Bidder need to be presented in the form of very good quality documents or reports. The following list covers few of the deliverables.

- 1) PFDs of CCWS-2F and CHWS-H4 in AVEVA Diagram
- 2) P&IDs of CCWS-2F and CHWS-H4 in AVEVA Diagram
- 3) The hydraulic and thermal analyses (steady state and transient) by using AFT Fathom and AFT Impulse. Detailed report shall be prepared for both analyses for CCWS-2F and CHWS-H4 covering all operational/ transient scenarios.
- 4) SLD, cabling diagram, instrumentation diagrams and routing diagram in SSD software.
- 5) All the documents, drawings and models in parent software
- 6) All documents and reports for all activities mentioned in section 5.
- 7) Separate reports/ design notes of other activities like stress analysis, pipe support (including primary supports) analyses, interface loads, earthing schemes, etc
- 8) Technical specification of equipment, Bill of Quantities, MIP (Quality Assurance Plans), etc...
- 9) Technical offers/drawings received from OEMs that are used for finalizing design and/or technical specifications.
- 10) Design compliance matrices (DCM) for CCWS-2F and CHWS-H4

5.4 Exclusion


Exclusions from this tender are listed below;

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- 1) Procurement and supply of any equipment, item and component of CCWS-2F and CHWS-H4 is excluded from this tender.
- 2) Development of plant control software is excluded from this tender.

6 Design Requirements

- 1) The design of the CCWS-2F and CHWS-H4 and its components shall conform to the requirements stipulated in System Requirement Documents, Interface Control Documents and Interface Sheets.
- 2) Applicable codes, standards, regulations from Section 4.2 and System Requirement Documents shall be followed for the design of CCWS-2F and CHWS-H4.
- 3) The CCWS-2F and CHWS-H4 shall be designed to reject all heat from serving clients in all scenario and states of ITER operation and maintain supply temperature as required.
- 4) The CCWS-2F and CHWS-H4 shall be controllable and adjustable, to allow operation at different heat loads between the maximum cooling demand and reduced cooling requirements of the initial years of the plasma experiments, and to adjust to differences in heat loads during different ITER operation states.
- 5) The CCWS-2F and CHWS-H4 shall maintain cooling water temperatures, pressures, and flow rates to ensure component / clients cooling.
- 6) The CCWS-2F and CHWS-H4 shall be designed for a minimum operational life time of 30 years.
- 7) The CCWS-2F and CHWS-H4 shall have venting, draining and refilling provisions.
- 8) Commissioning and installation aspects shall be considered while designing the systems.
- 9) Design flow velocity in pipes shall be 2.5 m/sec. Flow velocity in pipes shall not exceed 4 m/sec.
- 10) Systems shall be designed considering the loads, load combinations, floor and ground response spectra as per the Load Specifications. Refer Annexure - A for load combinations and Annexure - B for FRS. FRS shall be reconfirmed before start of analysis.
- 11) Dynamic analyses of system performance during pulse operations for each of the reference plasma scenarios shall be performed during design to verify design adequacy.
- 12) The CCWS-2F and CHWS-H4 shall be capable to maintain water chemistry of circulating water within prescribed limits in interface documents and SRDs. And shall provide sampling capability for periodic sampling.
- 13) The CCWS-2F and CHWS-H4 shall be designed so they shall be capable of operating in CODAC and local control modes. The CCWS-2F and CHWS-H4 and its control system shall be capable to handle all operation of ITER in different scenarios as per ITER machine operation plan.
- 14) The layouts shall be designed such as to provide adequate working space and operator access for operation and maintenance. Suitable arrangements (platforms, ladders, handling

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equipment, open space, etc...) shall be provided by the designer to enable operation, supervision, installation and maintenance of equipment, components, piping and valves. Adequate space shall be ensured for dismantling, removal and installation of the assemblies/ sub- assemblies of the equipment. The design shall allow natural draining of equipment, components and piping through drains and various openings on floors by gravity to nearby suitable discharge point/ plant drain chamber. The bidder is required to collect details from the potential suppliers of equipment, components and valves while making the layouts.


- 15) The design covered in this tender shall comply with the latest editions as on the date of award of the contract (including amendments thereto of currently applicable codes), standards, statutes, regulations and safety codes in the locality where the equipment will be installed but not limited to the codes and standards listed in input documents. Nothing in this tender shall be construed to relieve the bidder of this responsibility. In addition, relevant international codes and standards shall be followed/ added, as per requirement, subject to Purchaser's approval.
- 16) CAD requirements shall be followed from ITER CAD manual.
- 17) ISO 9001:2015 requirements shall be followed for the execution of the contract.
- 18) Design review shall be performed as per ITER Design Review Procedure (ITER_D_2832CF).
- 19) A formal design review meeting conducted during the development phase of the design to monitor the progress of the design and to assure that the requirements are properly defined, verified and properly documented in the sub-system requirement specification; the layout and interfaces have been fixed; a design concept that meets those requirements has been developed and supporting analyses and R&D are being carried out; outstanding design, construction and operation risks are identified and mitigated; and a firm basis exists to proceed with final (detailed) design.

6.1 Major Constraints

- 1) Building 63 is a two-storey steel-frame building allocated for equipment of CCWS-2F and CHWS-H4. Space available (two floors of 12m x 47m approx.) in building 63 for CCWS-2F and CHWS-H4 equipment layout is very limited. It is not possible to allocate additional space during design phase. Hence, design of CCWS-2F and CHWS-H4 shall be carried out considering this constraint. Space constraint is also applicable for piping distribution routing in other buildings and trenches.
- 2) Maximum mass flow rate (from Heat Rejection System) available on secondary side of CCWS-2F heat exchangers is limited as it is not possible to install additional pumps in HRS. Hence, design of CCWS-2F and CHWS-H4 shall be carried out respecting this constraint.

7 Software Requirements

These software will be utilized in the execution of the contract. Licensed software version shall be used. All the software and its expert manpower for the execution of the contract shall be arranged by the bidder.


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- 1) The PFD should be developed in AVEVA Diagram with contractor's licenses through online access on IO's server OR in SSD. (Purchase of license is not required for SSD. ITER-India will provide online access to SSD server.)
- 2) The P&IDs should be developed in AVEVA Diagram with contractor's licenses, through online access on IO's server.
- 3) Hydraulic analysis shall be performed by using AFT Fathom version 12 and AFT Impulse version 9.
- 4) 3D models shall be developed in AVEVA E3D Design with contractor's licenses through online access on IO's server. Isometrics shall be exported from AVEVA E3D Design. General Arrangement drawings and Support's drawings shall be developed in AVEVA E3D Design. Other drawings, if required, can be prepared in AUTO CAD.
- 5) Piping stress analysis shall be performed in CAESAR II 2017.
- 6) Structural / support analysis shall be performed in STAAD.Pro V8i Series 6.
- 7) Single Line Diagram and cabling diagram shall be prepared in SSD. (Purchase of license is not required. ITER-India will provide online access to SSD server.)
- 8) Electrical calculations, sizing, diagrams, network short circuit, load flow, relay coordination and motor starting studies shall be performed in ETAP (Yr. 2022) 22.02.
- 9) Documents and reports shall be prepared in Microsoft Word and/ or Microsoft Excel. Prepared documents and reports can be submitted in pdf format or xls in case of BOMs/ BOQs/ lists.

8 Submission of design documents and revision

ITER-India's web-based document management portal called INDUS shall be used for data exchange and submission of documents/ deliverables. Access to INDUS shall be provided to concerned team members of the bidder at the start of the contract. The bidder shall submit design documents considering the input given by ITER-India along with the inputs generated based on various systems designs carried out by the bidder. The bidder shall incorporate the comments/ additional inputs provided by ITER-India on the documents/ deliverables submitted by the bidder and submit the same for approval of ITER-India. It may be noted that before submission of the revision, if further input/changes are required to be incorporated in the drawing/ document/ deliverables, the same shall be made so by the bidder in that revision itself and it will not be considered as the next revision. However, fresh changes/comments if any, proposed by ITER-India after submission of revised document/ drawing by bidder shall be considered for incorporation in next revision.

During execution of the tender work, some changes may be required in various drawings, documents, reports, P&IDs, 3-D model/ database, etc due to mismatch in availability of space for equipment location, change in room sizes/ member sizes and revision in other engineering inputs, change in design basis inputs, various design loads, etc. Changes in the above design input may call for re-analysis and re-design which shall impact the number of revisions.

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Maximum of three versions allowed for each deliverable. In the following conditions, it shall not be treated as new version

- a) Comments in the previous version are not incorporated in the subsequent version
- b) The version does not contain optimized or appropriate or complete design
- c) The version submitted with minor changes due to some discrepancies or minor changes in input

If there is no comment/ approval from ITER-India within 15 working days from the date of submission, it is considered as approved. The revisions shall be carried out by bidder, only after written instruction by ITER-India.

Softcopies (including native files of all calculations/analyses/reports/documents) shall be uploaded in appropriate folder in INDUS. Editable copies of all drawings, figures, sketches used in various documents, reports shall also be submitted.

9 Execution Plan

While executing the tasks, a close coordination is to be established among ITER-India, ITER-IO and the bidder. On award of the contract, the bidder should designate a responsible coordinating person, to serve as the main contact between ITER-India and the bidder. Project Manager, CWS, ITER-India will nominate a coordinating person for ITER-India's communications. The complete work shall be done by the bidder at his works which shall be equipped with requisite infrastructure.


The bidder shall execute the work strictly as per the terms and conditions as stipulated in this tender document. The bidder needs to submit ITER-India a fortnightly progress report on all the works carried out in that fortnight and expected works in the following fortnight. Progress review meetings shall be conducted as required by the ITER-India, at their office or at bidder's place upon mutual agreement. There shall be weekly teleconferences also to review the performance. The meeting minutes shall be prepared by the bidder and submitted to the ITER-India not later than 2 (two) calendar days after the meeting.

9.1 Manpower deployment

The bidder shall deploy manpower, who have relevant experience and education qualification, till the completion of contract. The bidder should submit the names, qualifications, experience and the credentials of the persons working on this contract, if asked by ITER India. The bidder has to manage all the required software for contract execution.

10 Design completion & Final Acceptance

Acceptance of the deliverables including report/ document/ drawing/ 3D model/ technical specifications will be subjected to the final approval of ITER-India and ITER-IO. During this, if any revisions are required, such revisions are to be carried out by the bidder without any additional cost. Any chits (queries or comments) arise during the review, need to be resolved by the bidder. **The**

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resolution of these chits (queries or comments) and final acceptance of all deliverables by ITER-India shall end the design contract.


The technical documents for tender of ‘detailed design, engineering and procurement of CCWS-2F and CHWS-H4’ prepared by the bidder shall be reviewed by ITER-India and the third party appointed by ITER-India. **The approval and acceptance by ITER-India shall end the activity namely preparation of technical specifications for tender.**

11 Input Documents

Input documents which are required to carry out design mainly consist of interface documents, system requirement documents, conceptual design input package, code and standards with local regulations, ITER reference documents, ITER guidelines and ITER procedures as applicable.

The following documents and drawings shall be furnished to the successful bidder as the design inputs.

- Interface Control Document and Interface Sheets which contains the functional and physical interface requirements of serving or interfacing clients/ systems. List are as below;
 - DRAFT BASELINE 2024: ICD between PBS 26-CC and PBS 26-CH (B6RVUK)
 - DRAFT BASELINE 2024: ICD between PBS 26-HR and PBS 26-CC (B6RU8H)
 - DRAFT BASELINE 2024:Interface Sheet (IS) IS-26-CC-26-HR-001/002 (B6Z8QB)
 - Draft Baseline 2024: Interface Sheet (IS) IS-26-CC-26-CH-001 (B7ALKM)
 - DRAFT BASELINE 2024: ICD-43-26.SCSU Interface Control Document between the Steady State Electric Network (SSEN, PBS 43) and the Secondary Cooling Support Unit (SCSU, PBS 26.CC,26.CH,26.HR) (B6YCMQ)
 - DRAFT BASELINE 2024: IS-43-26.SCSU-008 Interface between the SSEN LV Class II IP power supply and the SCSU (B6ZXRH)
 - DRAFT BASELINE 2024: IS-43-26.SCSU-004 Interface between the SSEN LV Class IV OL power supply and the SCS (B6ZMFT)
 - DRAFT BASELINE 2024: IS-43-26.SCSU-001 Interface between the SSEN MV Class IV OL power supply and the SCSU (B6ZUWD)
 - DRAFT BASELINE 2024: ICD-26.CC/CH-52 Interface Control Document for Component Cooling Water System (PBS26.CC/CH) and the Electron Cyclotron Heating and Current Drive System (PBS 52) (AM6DJL)
 - DRAFT BASELINE 2024: IS-26.CH-52-005 Interface sheet component cooling water system (PBS26.CH.H4)-ECH&CD system(PBS52.TL) (AM6ENV)
 - DRAFT BASELINE 2024: IS-26.CC-52-004 Interface sheet component cooling water system (PBS26.CC.2F)-ECH&CD system(PBS52.RF.25-80 & PBS52.HV.13-40) (AM6E9N)
 - DRAFT BASELINE 2024: ICD-26.CC,CH-55 Interface Control Document for Component Cooling & Chilled Water Systems (PBS 26-CC, -CH) and Diagnostics (PBS 55) (AR6746)
 - DRAFT BASELINE 2024: IS-26.CC-55-001 Interface between CCWS & Diagnostics System (ARKJLK)


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- DRAFT BASELINE 2024:Interface Sheet (IS) IS 26-CH-55-001 (B726AD)
- DRAFT BASELINE 2024: Interface Control Document (ICD) between Building 63 (PBS 63.63) and PBS 26 (AS3U6G)
- DRAFT BASELINE 2024: IS-26.CC/CH/HR-63.63 (B725C5)
- DRAFT BASELINE 2024: ICD-26-61.00.00.SF (Special Foundations (Generic for Site)) (AT4MHX)
- DRAFT BASELINE 2024: IS-26-61.00.00.SF (Special Foundations (Generic for Site)) (ATECDL)
- DRAFT BASELINE 2024: Interface Control Document (ICD) between Building (PBS 63-15) - PBS 26 (AV6R2R)
- DRAFT BASELINE 2024: IS-26.CC/CH/HR-63.18 (RF Heating Building 2 (ECH & CTS)) (B727CN)
- DRAFT BASELINE 2024: Interface Control Document (ICD) between Building 18 (PBS 63-18) - PBS 26 (RF Heating Building 2 (ECH & CTS)) (B726NF)
- DRAFT BASELINE 2024: ICD-26.CC-65.00.CA/DW/NG Interface Control Document (ICD) between Compressed Air, Demineralised Water and Nitrogen Distribution (PBS 65-00-CA/DW/NG) - Component Cooling Water (PBS 26-CC) (B65WWB)
- DRAFT BASELINE 2024: ICD-26.CH-65.00.CA/DW/NG Interface Control Document (ICD) between Compressed Air, Demineralised Water and Nitrogen Distribution (PBS 65-00-CA/DW/NG) - Chilled Water (PBS 26-CH) (B6RS7J)
- DRAFT BASELINE 2024:IS-26-65-001 Interface between Liquid & Gas Distribution (PBS 65) and Cooling Water System (PBS 26) (B6RTQZ)
- System Requirements Documents (SRD) for CCWS-2F and CHWS-H4 contains the system specific requirements. SRDs are also containing the relevant ITER reference documents which shall be followed for system design. Common requirements from SRD of CCWS shall also be applicable for CHWS-H4 system and vice versa. SRDs are listed below,
 - DRAFT BASELINE 2024: SRD-26-CH (9FB4UC)
 - DRAFT BASELINE 2024: SRD-26-CC (ARX8UK)
- All documents, P&IDs, diagrams, calculations, analysis, drawings and 3D model prepared during the Conceptual Design shall be provided as input. List of the documents of conceptual design are listed in below table;

Table 11-1: List of CDR documents

Sr. No.	Title	ITER Document No.
1.	3dxml of CCWS-2F	A7L3AB
2.	CCWS-2F Collection Tank Volume serving B63	BGDMLL
3.	CCWS-2F Design Conditions Calculation	AS8CU5
4.	CCWS-2F Heat Loss in Building 18	7NGEU2
5.	CCWS-2F Instrument List	6UEFTW
6.	CCWS-2F Preliminary System Sizing Calculation	AS89HN
7.	CCWS-2F Thermal-Hydraulic Model (Fathom)	ASLC7S
8.	CCWS-2F Valves and Equipment List	6UE6P2

Sr. No.	Title	ITER Document No.
9.	CCWS-2F water chemical quality for ECH Cryocompressors	ASLVCF
10.	DRAFT BASELINE 2024: CCWS-2F Equipment List B18	BGE9AY
11.	DRAFT BASELINE 2024: CCWS-2F Equipment List B63	BGELFD
12.	DRAFT BASELINE 2024: CCWS-2F instrument List B63	A54X2G
13.	DRAFT BASELINE 2024: CCWS-2F Line List B15	B7EEW6
14.	DRAFT BASELINE 2024: CCWS-2F Line List B18	BGDZDR
15.	DRAFT BASELINE 2024: CCWS-2F Line List B18_OUT	BFXYS6
16.	DRAFT BASELINE 2024: CCWS-2F Line List B63	BFY537
17.	DRAFT BASELINE 2024: CCWS-2F Line List B63_OUT	BGDRDP
18.	DRAFT BASELINE 2024: CCWS-2F Valve List B15	BFXUXK
19.	DRAFT BASELINE 2024: CCWS-2F Valve List B18	9X4SRG
20.	DRAFT BASELINE 2024: CCWS-2F Valve List B18_OUT	9ZF4T8
21.	DRAFT BASELINE 2024: CCWS-2F Valve List B63	B5ZEDD
22.	DRAFT BASELINE 2024: CCWS-2F Valve List B63_OUT	9X4MXV
23.	DRAFT BASELINE 2024: Design Compliance Matrix for 26CCWS-2F	BFHVQ2
24.	DRAFT BASELINE 2024: Design note of Water Polishing Unit (WPU) for CCWS-2F	B7RZCE
25.	DRAFT BASELINE 2024: GA Drawings for B13 CDR	BBVAB9
26.	DRAFT BASELINE 2024: GA Drawings for B15-L3 CDR	BFHSEM
27.	DRAFT BASELINE 2024: GA Drawings for B18 CDR	B2Z5Y8
28.	DRAFT BASELINE 2024: GA Drawings for B18_OUT CDR	BBR3LB
29.	DRAFT BASELINE 2024: GA Drawings for B20 CDR	B9TWC9
30.	DRAFT BASELINE 2024: GA Drawings for B20_OUT CDR	AF9SKP
31.	DRAFT BASELINE 2024: GA Drawings for B63 CDR	AQLFWH
32.	DRAFT BASELINE 2024: GA Drawings for B63_OUT CDR	ASHKB3
33.	DRAFT BASELINE 2024: PED Hazard Categorization for CCWS-2F Piping and Equipment	B7E66Q
34.	Heat Loss Calculation in B63	7G7B6C
35.	Logic Notes for the CCWS-2F P&ID	ASLNQ4
36.	Maintenance plan for CCWS-2F	ASMDCF
37.	Piping and Instrumentation Diagram P&ID of CCWS-2F	A73JWK
38.	Process Flow Diagram of CCWS-2F	9X6AFX
39.	CHWS-H4 Fathom Model	B5ZHVV
40.	DRAFT BASELINE 2024: CHWS-H4 Design Conditions Calculation	B5ZAW3
41.	DRAFT BASELINE 2024: Design note of Water Polishing Unit (WPU) for CHWS-H4	B5ZDN7
42.	DRAFT BASELINE 2024: CHWS-H4 System Sizing Calculation and Datasheet	B5Z9RR
43.	DRAFT BASELINE 2024: CHWS-H4 Process Flow Diagram (PFD)	9FSQQ7
44.	DRAFT BASELINE 2024: Piping and Instrumentation Diagram of CHWS-H4	9FSVBT
45.	DRAFT BASELINE 2024: CHWS-H4 Valve List. B63	9SNRLP
46.	DRAFT BASELINE 2024: CHWS-H4 Logic Notes	9GDFXA
47.	DRAFT BASELINE 2024: CHWS-H4 Line List B18_OUT	BGDPAQ
48.	DRAFT BASELINE 2024: Design Compliance Matrix for 26CHWS-H4	BFY7QH
49.	DRAFT BASELINE 2024: CHWS-H4 Line List B15	BFXXUD


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Sr. No.	Title	ITER Document No.
50.	DRAFT BASELINE 2024: CHWS-H4 Line List B63	BGDYRT
51.	DRAFT BASELINE 2024: CHWS-H4 Line List B63_OUT	BGDTB9
52.	DRAFT BASELINE 2024: CHWS-H4 Line List B18	BGDSEX
53.	DRAFT BASELINE 2024: CHWS-H4 Valve List. B18	BFHVV L
54.	DRAFT BASELINE 2024: PED hazard categorization for CHWS-H4 piping and equipment	B5ZH2J
55.	DRAFT BASELINE 2024: CHWS-H4 Equipment List B63	BGEMZE
56.	DRAFT BASELINE 2024: CHWS-H4 Instrument List. B63	BFXUKH
57.	DRAFT BASELINE 2024: CHWS-H4 Instrument List. B18	BFXSUN
58.	DRAFT BASELINE 2024: CHWS-H4 Valve List. B15	BFXQTL
59.	DRAFT BASELINE 2024. CCWS-2F and CHWS-H4 PRELIMINARY POWER SUPPLY REQUIREMENTS PBS26	8ZY5G4
60.	Draft Baseline 2024. Preliminary Electrical Load List For CHWS-H4	AW4K4T
61.	Draft Baseline 2024. Preliminary Electrical Single Line Diagram for PBS26 CHWS-H4 and CCWS-2F	95ZG34
62.	DRAFT BASELINE 2024: Preliminary Electrical Equipment List for CCWS-2F	B2USA7
63.	DRAFT BASELINE 2024: Preliminary Control System Architecture CCWS-2F and CHWS-H4	ARMWAH
64.	DRAFT BASELINE 2024: Preliminary Control System I/O List CCWS-2F	AV6XX5
65.	DRAFT BASELINE 2024: Preliminary Control system I/O List CHWS-H4	AU4LQH
66.	DRAFT BASELINE 2024: Preliminary Electrical cable list CCWS-2F	AM9N6T
67.	DRAFT BASELINE 2024: Preliminary Electrical cable list CHWS-H4	AM9M8K
68.	DRAFT BASELINE 2024: Preliminary Electrical Equipment List for CHWS-H4	B2UKW7
69.	DRAFT BASELINE 2024: Preliminary Electrical Load List for CCWS-2F	B2MK32
70.	DRAFT BASELINE 2024: Preliminary I&C Equipment List for CCWS-2F	B2UEZ5
71.	DRAFT BASELINE 2024: Preliminary I&C Equipment List for CHWS-H4	B2U86Q
72.	Electrical Design Basis Report for CCWS, CHWS and HRS	ARRJFJ-C 34N9Q7
73.	LV Motor Control Philosophy for CCWS, CHWS and HRS	ARRJFJ-A SQKL9N
74.	MV Motor Control Philosophy For CCWS, CHWS and HRS	ARRJFJ-B 64JF5S
75.	Process Instrumentation hook-up guidelines	ARRJFJ.D


- Load Specification for Cooling Water System located in B11, B13, B14, B15 and annex, B21, B23, B24, B37 and annex, B74 (ITER_D_XLTXGR)
- Load Specification for Cooling Water System (ITER_D_3YGYH7)

Along with the above, the following is the list of major reference documents/ drawings, which shall be useful for carrying out the design as well preparation of technical document for detail design, engineering and procurement of systems. The soft copy of these documents shall be furnished to the successful bidder. Moreover, the access to ITER Document Management (IDM), as required, will be provided after award of contract to download other relevant documents.

- Quality Classification Determination (ITER_D_24VQES)

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- Design Review Procedure (ITER_D_2832CF)
- Manufacturing and Inspection Plan (ITER_D_22MDZD)
- Design collaboration implementation forms (DCIF) for CCWS, CHWS and HRS
- Quality Requirements for IO Performers (ITER_D_22MFG4)
- Electrical Design Handbook - Part 1: Introduction (ITER_D_2F7HD2)
- Electrical Design Handbook – Part 2: Terminology & Acronyms (ITER_D_2E8QVA)
- Electrical Design Handbook – Part 3: Codes & Standards (ITER_D_2E8DLM)
- Electrical Design Handbook – Part 4: Electromagnetic Compatibility (ITER_D_4B523E)
- Electrical Design Handbook – Part 5: Earthing and Lightning Protection (ITER_D_4B7ZDG)
- Plant Control Design Handbook (ITER_D_27LH2)
- Decree on design and construction of pressure equipment (Decree 99-1046 with latest updates)
- ITER Numbering System for Parts/Components (ITER_D_28QDBS)
- Standardization Work Plan (ITER_D_2NT3E2)
- Site master plan and clients building drawings
- 3D Product catalogue in AVEVA as available
- Operations handbook (ITER_D_452SZX)
- Operations Handbook - 2 Operational States (ITER_D_2LGF8N)
- ITER Plant Breakdown Structure (ITER_D_28WB2P)
- ITER site meteorology (ITER_D_2UT36S)
- ITER CAD Manual (ITER_D_249WLQ)
- CAD Manual 12-2 Piping Design (ITER_D_33WL3N)
-
- Codes and Standards for ITER Mechanical Components (ITER_D_25EW4K)
- ITER Structural Design Code for Buildings (ITER_D_283B24)
- Safe Access for Maintainability (ITER_D_RUGWUK)
- ITER Seismic Nuclear Safety Approach (ITER_D_2DRVPE)
- IO cable Catalogue (ITER_D_355QX2)
- IO cabling Rule (ITER_D_335VF9)
- ITER document template, as applicable
- Safety Important Functions and Components Classification Criteria and Methodology
ITER_D_347SF3
- Piping Stress Analysis Procedure for Cooling Water System (ITER_D_WULY78)
- Secondary Structure Stress Analysis Procedure for Cooling Water System (ITER_D_WSRVJ7)
- QP Template for suppliers and subcontractors. (ITER_D_2MLX45)
- ITER_D_7M2YKF Order dated 7 February 2012 relating to the general technical regulations applicable to INB - EN

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Annexure - A: Load Combinations for Piping and Support Design

Table A-1: Load Combinations for Piping

Service Level	Event Category	Load Combinations
A	I	$P + D_w + T + TR$
		$P + D_w + T + TR + WIN_n + SNOW_n + D_{yI}$
B	II	$P + D_w + T + TR + SL-1/EC8 + SAM_{SL-1/EC8}$
		$P + D_w + T + TR + SL-1/EC8 + SAM_{SL-1/EC8} + D_{yII}$
		$P + D_w + T + TR + WIN_e + D_{yII}$
		$P + D_w + T + TR + WIN_e + SNOW_n + D_{yII}$
		$P + D_w + T + TR + SNOW_e + D_{yII}$
		$P + D_w + T + TR + SNOW_e + WIN_n + D_{yII}$
Hydrostatic Test		$P_{test} + D_{test}$

Table A-2: Load Combinations for Supports

Service Level	Event Category	Load Combinations
A	I	$D_w + T_{env} + \text{Piping Loads CAT I}$
		$D_w + T_{env} + \text{Piping Loads CAT I} + WIN_n + SNOW_n$
B	II	$D_w + T_{env} + \text{Piping Loads CAT II} + SL-1/EC8 + SAM_{SL-1/EC8}$
		$D_w + T_{env} + \text{Piping Loads CAT II} + WIN_e$
		$D_w + T_{env} + \text{Piping Loads CAT II} + WIN_e + SNOW_n$
		$D_w + T_{env} + \text{Piping Loads CAT II} + SNOW_e$
		$D_w + T_{env} + \text{Piping Loads CAT II} + SNOW_e + WIN_n$

Description about the load symbols are below;

Load	Description
D_{yI}	Water Hammer Category I
D_{yII}	Water Hammer Category II
D_w	Dead Weight
D_{test}	Dead Weight in test condition
P	Design Pressure
P_{test}	Pressure Test
$SAM_{SL-1/EC8}$	Anchors and Supports Displacement due to seismic event SL-1/EC8
EC8	Eurocode 8 non nuclear Seismic Event
SL-1	Seismic Event Level 1
T_{env}	Environmental temperature
T	Different temperature load cases
TR	Thrust Load
$SNOW_n$	Normal Conditions Snow Load
$SNOW_e$	Extreme Conditions Snow Load
WIN_n	Normal Conditions Wind Load
WIN_e	Extreme Conditions Wind Load

Note: This load cases are indicative and will be finalized during design.

Annexure - B: Floor and Ground Response Spectra

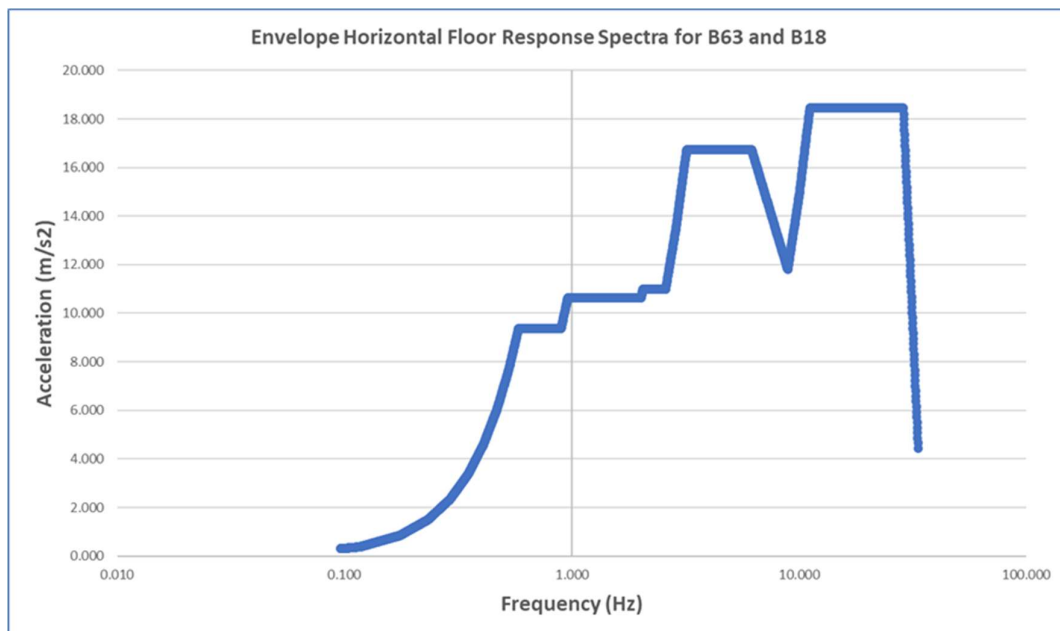


Figure B-1: Floor Response Spectra for B63 and B18

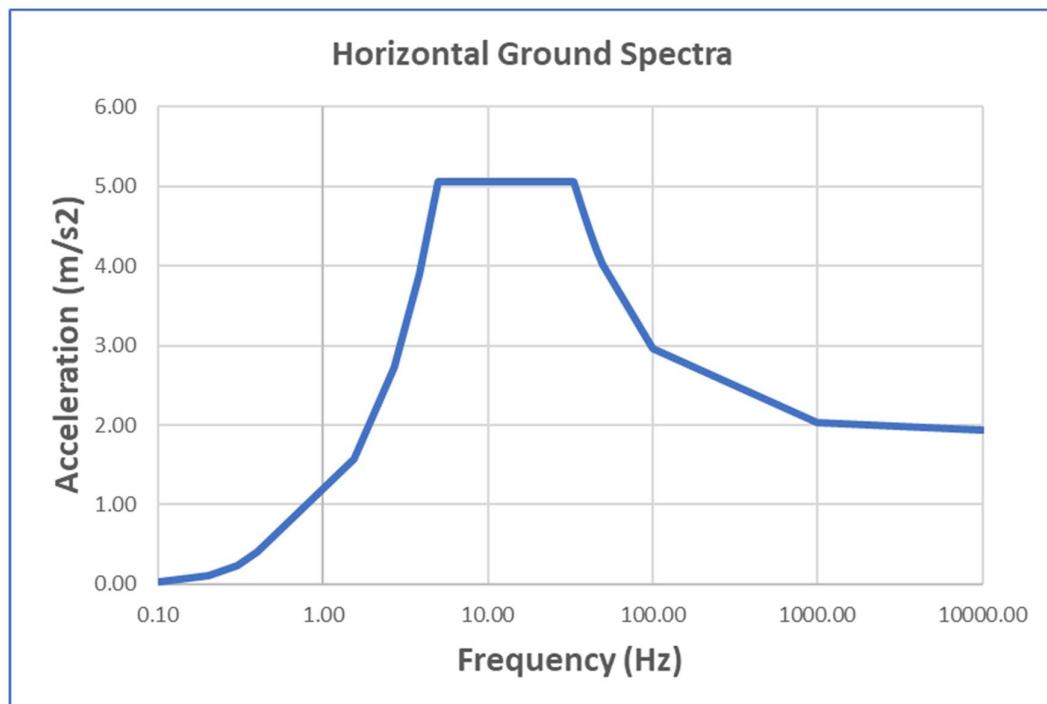


Figure B-2: Ground Spectra

Note: These FRSs are indicative and actual/ applicable FRSs will be provided during design to successful bidder.



Design of ITER Component Cooling Water System-2F (CCWS-2F) and
Chilled Water System-H4 (CHWS-H4)

GeM Bid No.

GEM/2025/B/6235104

Annexure - C: List of CDR Chits

Chit No.	Title	Chit Description	Proposal for Corrective Action	Criteria for Chit Closure
1	Concept of PBS 26 layout in B15 North L3 not integrable	As highlighted during the integration presentation (Slide #8, ITER_D_B9U8E2 - 11. PBS 26 CCWS-2F and CHWSH4 CDR: Design Integration), the current concept of PBS 26 layout in B15 North L3 is not compliant with the space available under the future PBS 52 false floor.	The slide #8 contains a proposal form DIS which is under discussion with the stakeholders (PBS52 and PBS 26)	Well integrated layout to be developed and model updated accordingly.
2	B18 - Concept of PBS 26 layout interfering with handling of PBS 52 component	As highlighted during the integration presentation (Slide #11, ITER_D_B9U8E2 - 11. PBS 26 CCWS-2F and CHWSH4 CDR: Design Integration), the current concept of PBS 26 layout in B18 is not allowing to secure the handling of the main PBS 52 components.	2 alternatives : 1 - refinement of PBS 26 layout in the same area in close collaboration with PBS 52 TRO. or 2 - relocation of PBS 26 piping in the nearby north room (to be noted: as this solution is impacting the bldg. design, it shall be implemented before completion of Preliminary Design of B18 - starting on July 2024-)	PBS 26 layout not impacting the handling of PBS 52 components.
3	PBS26 interface with PBS52	All the following are linked to the PBS26 major client PBS52: Heat load profile with time duration to be provided Drying mentioned by in 8.1.2.5 ,this function will not be provided by PBS26.CC.2F,maybe temporary method Suggest to detail the commissioning requirement in terms of flow/heat removal ITER_D_8SDSKB - Project Requirement Update // Scenario B // PBS52 Cooling Requirements existed together with IS ,to make sure the compliance. Other IDM comments to be well implemented :like 1.25 factor is for single or all gyrotrons	To agree on the solutions for the above comments and implemented the necessary ones into the interface between PBS52 and PBS26	PBS26 interface with PBS52 is agreed and updated



**Design of ITER Component Cooling Water System-2F (CCWS-2F) and
Chilled Water System-H4 (CHWS-H4)**

GeM Bid No.

GEM/2025/B/6235104

Chit No.	Title	Chit Description	Proposal for Corrective Action	Criteria for Chit Closure
4	PBS26 interface with PBS63	All the following points are linked the PBS26 interface with PBS63 Drainage and lifting to be agreed : Drainage during commissioning :to be declared clearly ,since at the very beginning ,the open flushing water may contain some more dust and huge quantity ,so may need some temporary connections Drainage due to WPU normal operation: this could be connected to HRS Drainage due to leakage: the two loops inventory is 1000m3 and 150 m3 each ,then 10 m3 tank is sufficient for all types of leakage? Drainage during maintenance ? Drainage design inside the building to be agreed Lifting during initial installation proposal is agreed Lifting during maintenance proposal is agreed	The proposed solutions are agreed and implemented the necessary ones	IS needs to be updated with more information.
5	Galvanic corrosion risk for high cost item	Check the client's wet material and ensure that there is no risk for galvanic corrosion to high cost items/components in both loops 2F & H4.	Check with client for MOC of cooling components, if not available and access the risk.	There should not be replacement risk to high cost item.
6	Missing IS with PBS45	Details on the content of this IS might evolve with the design but the interface will exist in any case,	Consider CC2F and CHH4 26-45 IS	Creation of the corresponding ISs.
7	Accumulator tank CHWS-H4	Accumulator is not only tank it should have proper mixing arrangement like sparger to average out heat or temperature of circulating water and hence stable inlet temperature to chiller.	para for function of accumulator tank	accumulator tank configuration to be defined.
8	Reuse of EDI reject	EDI reject of both loops can be routed to HRS and can be used as make up water. It can save drain of small amount of water. As both WPU on second floor of building, I hope gravity flow to basin is possible.	it can be used as make up water to HRS	If possible can be used.
9	Hazard Identification and Risk Assessment	In accordance with the ITER Occupational Health and Safety Management Plan (6LCG7B - section 6.3), Occupational Health and Safety risks (non-nuclear) shall be assessed through all phases (assembly, testing, operation, maintenance) (Procedure for Occupational Health and Safety Hazard Identification and Assessment (AJLQRF)).	Complete HIRA demonstration (ITER_D_RY8HAF) as input, and follow the HIRA process	HIRA report approved in IDM



Design of ITER Component Cooling Water System-2F (CCWS-2F) and
Chilled Water System-H4 (CHWS-H4)

GeM Bid No.

GEM/2025/B/6235104

Chit No.	Title	Chit Description	Proposal for Corrective Action	Criteria for Chit Closure
10	SRD and DCM finalization for both CCWS-2F and CH4	The SRD for CCWS has been updated for the new CCWS-2F loop, and the new SRD for CH.H4 has also been created. However due to the short time line, the propagation from the PR and the DRD must be formalized (and the creation of the REFS file). New Requirements to be identified formally. The formal DCMs have also been created and need completion. This work is not however expected to raise any significant issues on the SRDs and this design review	Complete formal DCMs Create RPM/RTM/REFS	DCMs to be approved before CDR closure SRD/RPM/RTM/REFS to be completed when the new PR for the Baseline 2024 is available
11	Provision for H4 chiller refrigerant storage	As a lesson learnt from H2, a container must be available in the vicinity of the chillers in order to be able to store the R134a refrigerant in case a given chiller needs to have its refrigerant loop emptied for any reasons (planned activities, leakage, ..). This is a legal / ICPE requirement. Depending on the refrigerant medium selected for H4, it is to be checked whether such a requirement applies here. If so, plan its location in the arrangement drawing.	Check at design phase whether such a requirement is valid for H4	Check has been made whether this requirement is applicable for H4.
12	Plinths in B63	Plinth supporting PBS26 equipment in B63 showed in the presentation are most probably not needed. Interface between PBS26 and PBS63 is to be refined.	Anchorage length required for the equipment is to be clarified and to be compared with slab thickness in order to minimise or delete the need of plinths in B63	Interface between equipment and building clearly defined
13	Installation/maintenance of PBS26 equipment in B63	It is to be clarified how the equipment will be installed and maintained in B63. need of rails? can a forklift or other means be used? Equipment at L2 - through facade or through the roof? This has an impact on building design. preferred solution: facade	PBS26 equipment installation and maintenance to be clarified and impact on building to be assessed.	PBS26 equipment installation and maintenance to be clarified

Annexure - D: Snaps from 3D Model

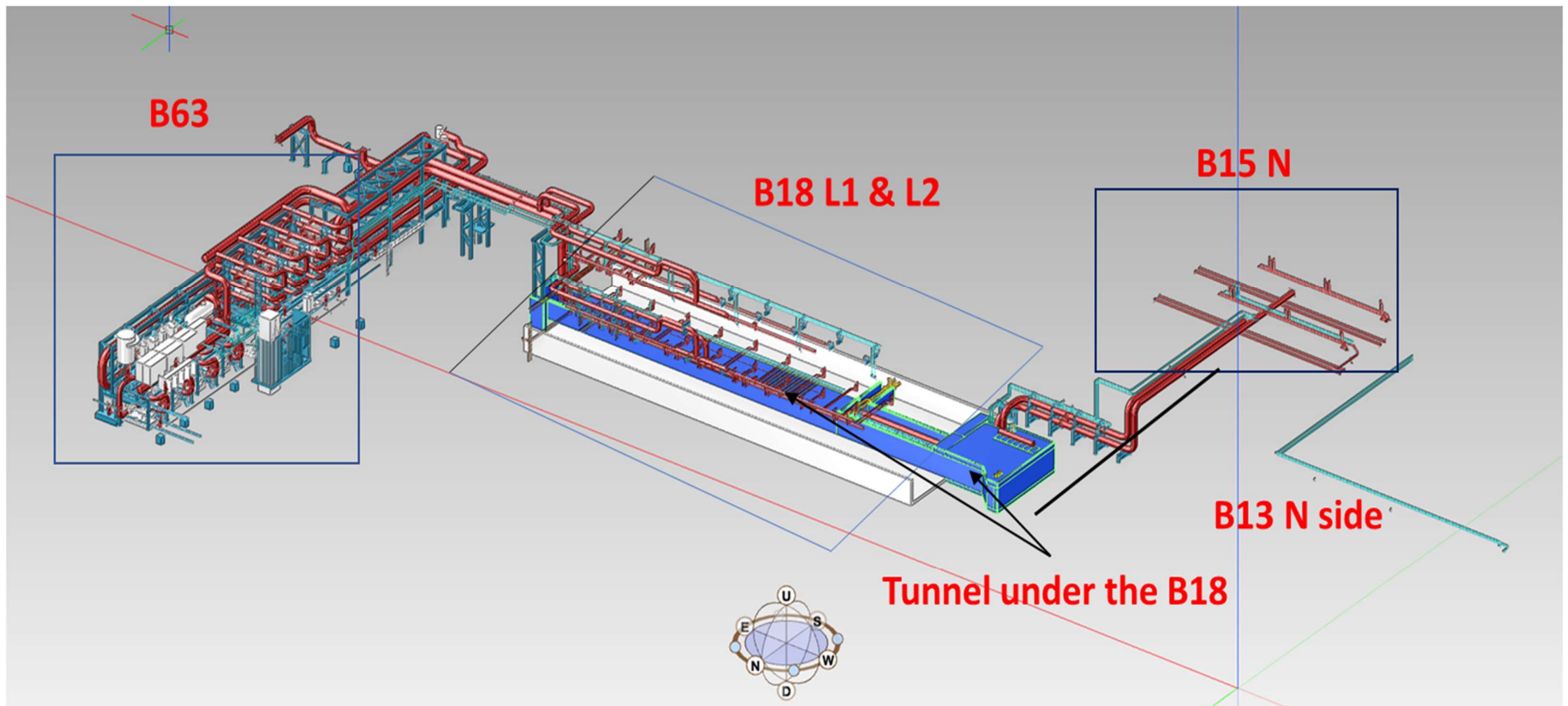


Figure D-1: Overall Piping Network of CCWS-2F and CHWS-H4

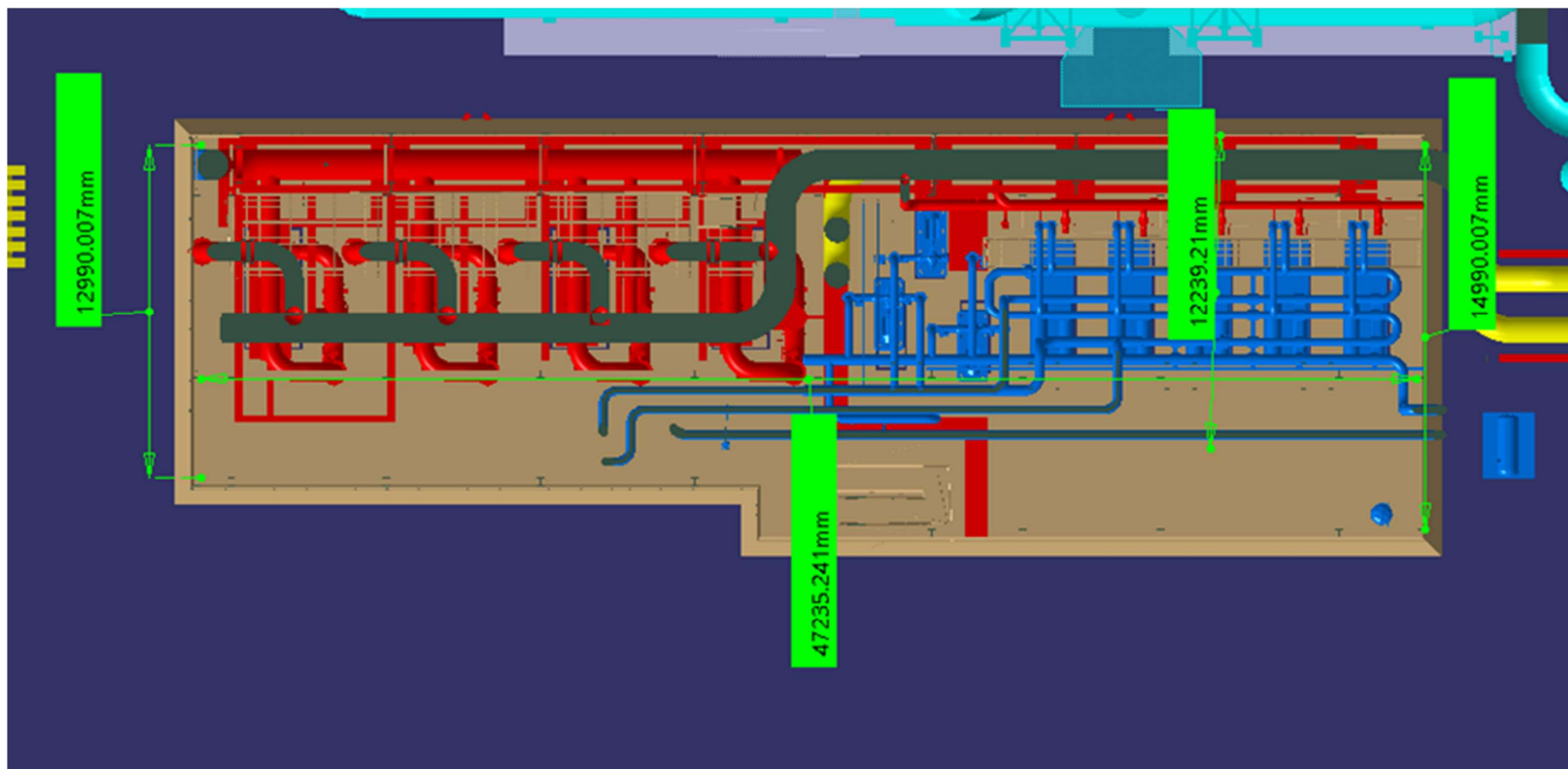


Figure D-2: Building 63 Level 1 with available overall dimensions

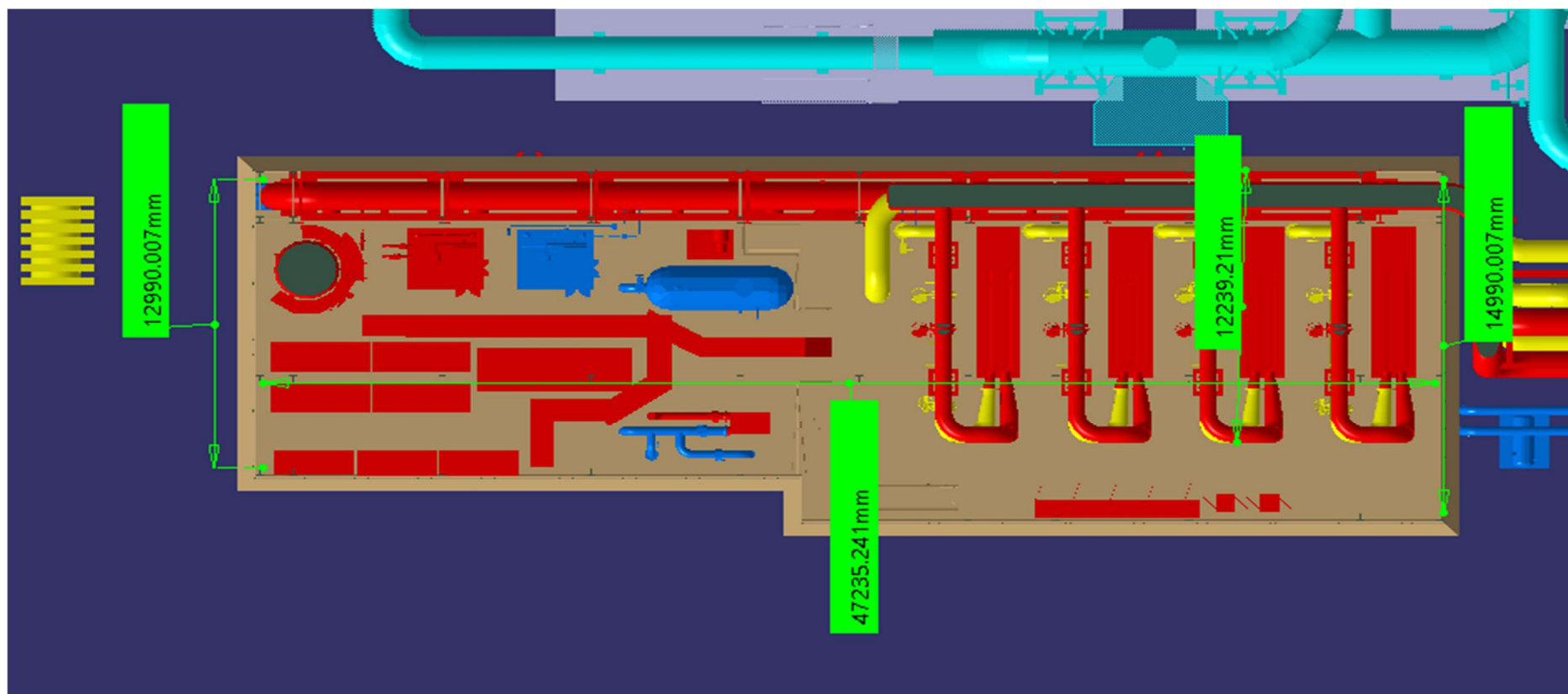


Figure D-3: Building 63 Level 2 with available overall dimensions



Annexure - E: Documents of CDR

Refer below listed documents for system detail. Go to link provided in table for documents.

Document	File
Piping and Instrumentation Diagram of CCWS-2F	<p>Please download zipped file from this link: https://owncloud.iter.org/index.php/s/yNCYcsC4zwTtJsQ (use password: 2025).</p>
Piping and Instrumentation Diagram of CHWS-H4	
Logic Notes of CCWS-2F	
Logic Notes of CHWS-H4	
CCWS-2F Preliminary System Sizing Calculation	
CHWS-H4 Preliminary System Sizing Calculation	
GA Drawing of Building 15	
GA Drawing of Building 18	
GA Drawing of Building 63	
Single Line Diagram of CCWS-2F and CHWS-H4	
I&C System Architecture of CCWS-2F and CHWS-H4	
3D model (3dxml)	