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EXTERNAL REFERENCE / VERSION

Technical Specifications (In-Cash Procurement)

Technical Summary for BOP-Group 6 Installation Works

The BOP Group 6 works include installation of all the following Items:Building 32 and 33 – PF Converters and Transformers Building 32 and 33 – TF, CC, CS, VS Converters Building 38 and Area 39 – Reactive Power Compensator and Harmonic Filter
It is limited to the workforce for the installation activities

The installation design , other engineering and commissioning tasks are not included in the scope of this contract

Technical Summary

1. Purpose

The purpose of this contract is to provide installation works of AC/DC Converters, Reactive Power compensator equipment and Harmonic filters inside and outside the following Buildings on the ITER Site in Saint-Paul Lez Durance, France:

- Building 32 – Magnet Power Conversion Building 1,
- Building 33 – Magnet Power Conversion Building 2,
- Building 38 – Reactive Power Control Building
- Area 39 – Reactive Power Compensator Area

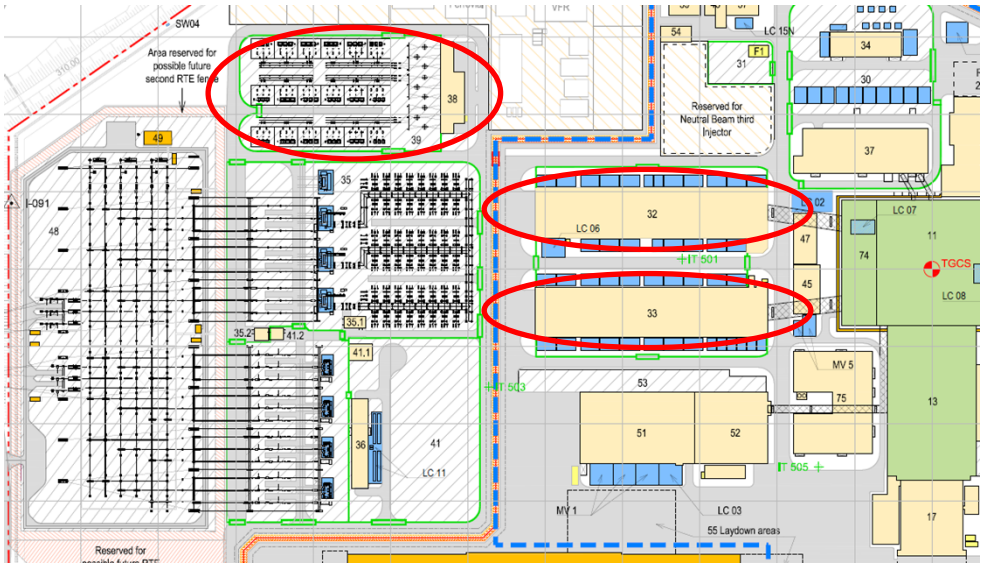


Figure 1 : ITER site overview, red circle cover the area of works

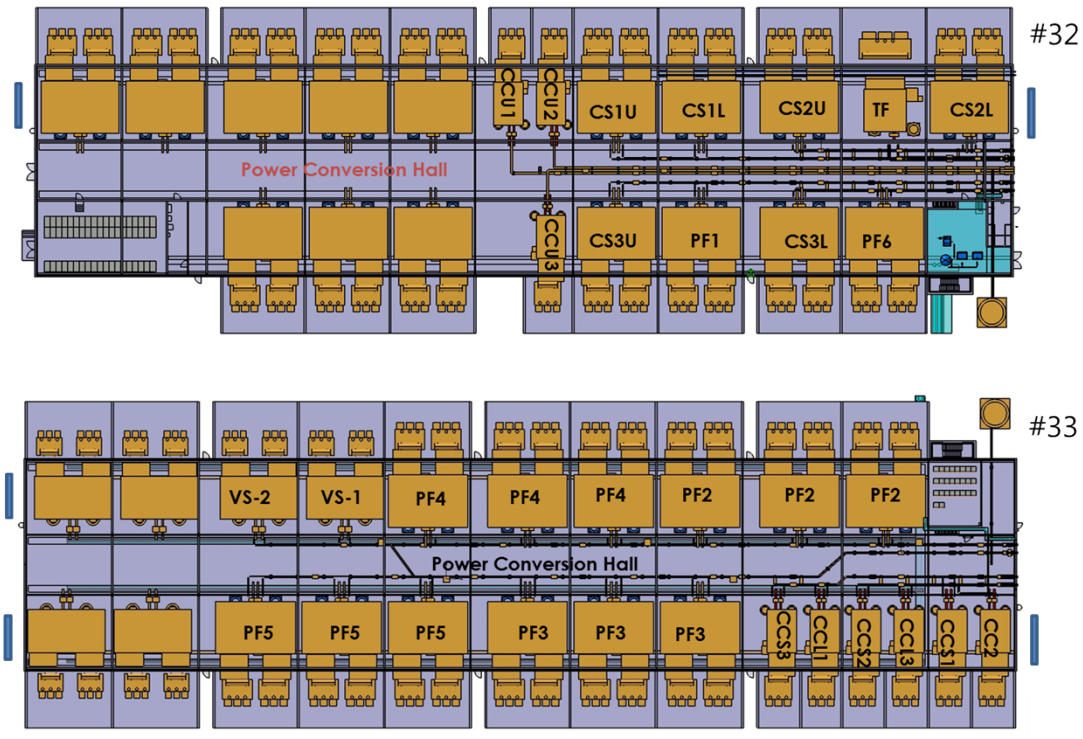


Figure 2 : Plan view of Buildings 32 and 33

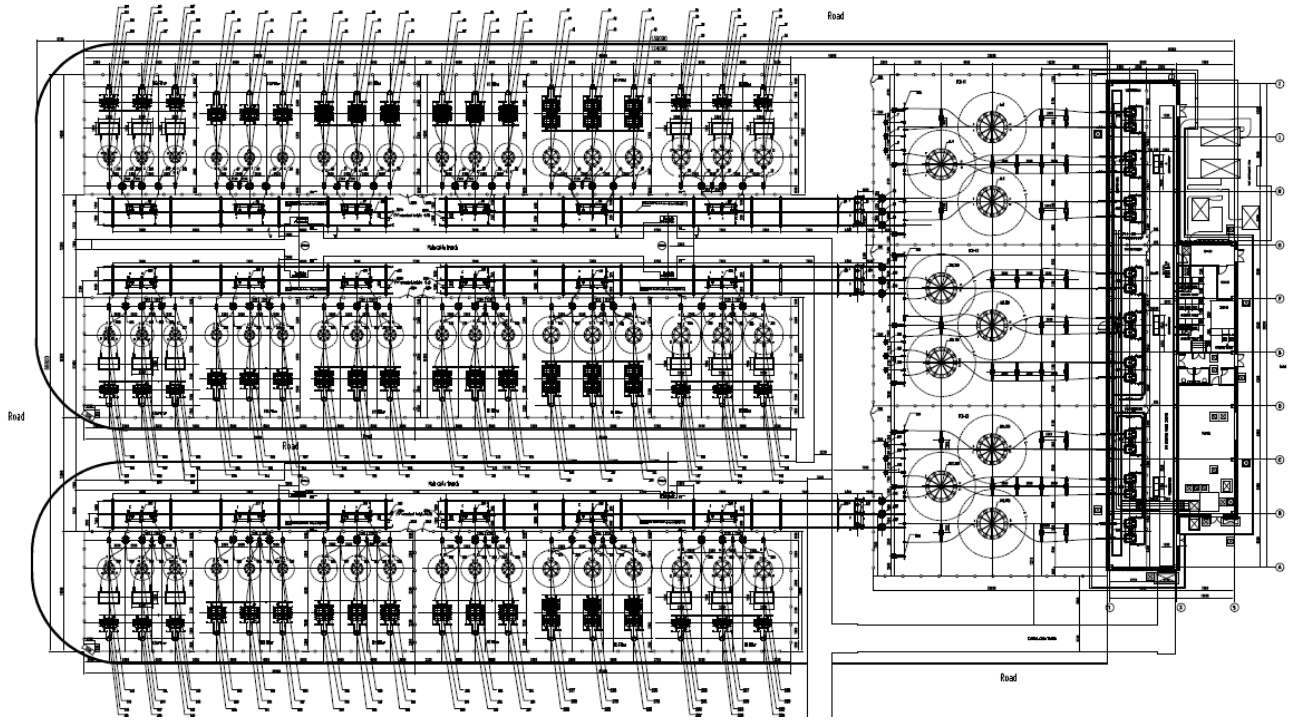


Figure 3 : Plan view of Buildings 38 and Area 39

The installation activities will include:

Equipment	**Building**
AC/DC Converter unit	32, 33
MV Transformer for AC/DC Converter	32, 33
Cooling water collector (CWC)	32, 33
Master control system (MCS)	32, 33
Dummy Load	32, 33
TCR Thyristor valves installation	38
TCR Reactor and filter	39
Harmonic Filter	39
Cables	32, 33, 38, 39
Cable Trays	32, 33, 38, 39
Control Cubicles	32, 33, 38
Steel Structures	32, 33, 38, 39
Fence Installation	39

2. Background

ITER is based on the 'Tokamak' concept of magnetic confinement, in which the plasma is contained in a doughnut-shaped vacuum vessel. The fuel - a mixture of Deuterium and Tritium, two isotopes of Hydrogen - is heated to temperatures in excess of 150 million °C, forming an hot plasma. Strong magnetic fields are used to keep the plasma away from the walls; these are produced by superconducting coils surrounding the vessel, and by an electrical current driven through the plasma.

ITER is a large research facility made of a combination of large conventional industrial equipment such as the cooling water system and challenging new high tech components such as diagnostics, superconductive magnets, etc. To ensure the future operation of all ITER subsystems a large amount of power and control cables will have to be designed, identified, routed and installed.

For more information on ITER Project please visit our web site www.iter.org.

3. Scope of Work

The installation works are to be performed in the following buildings:

- Building 32 – Magnet Power Conversion Building 1,
- Building 33 – Magnet Power Conversion Building 2
- Building 38 – Reactive Power Control Building
- Area 39 – Reactive Power Compensator Area

All the equipment to be installed shall be free issued by the ITER Organization (IO) to the Contractor, except for the components listed in the column “to be procured” of the below table, which items shall be provided by the Contractor.

The scope of the work to be awarded under this tender is split into three Lots, as follows:

- Lot 1: PF Converters and Transformer Installation in 32, 33
- Lot 2: TF,CS,CC and VS Converters Installation in 32, 33
- Lot 3: RPC and HF Installation in 38, 39

Pre-qualified Candidates shall be eligible to tender for all the Lots. Candidates shall be eligible to win all the Lots. During the tender phase, the tenderer shall submit offers for all the Lots.

The preliminary bill of materials is given below and is divided into (a) equipment to be supplied and installed and (b) equipment for installation only. Also included in the scope are all the associated finishing works and the testing for mechanical and electrical completion of the installation:

i) Electrical completion of installation, equipment includes, but is not limited to:
   - Normal inspection of each cables, wiring & termination
   - Normal inspection of cable and tray support, tray (fill), grounding, integrity.
   - Check of stress core installation for MV & HV cable
   - Check of bend radius of cables
   - Tests of continuity and megger testing (insulation)
   - Test of water leakage of all the water-cooling equipment

ii) Mechanical Completion for Control systems including validation of the measuring devices, but is not limited to:
- All wiring check & verified
- Inspected for continuity & insulation
- Loop check for confirmation to the automatic system
- Placing all the components in position
- Busbar connection
- Hose/flange connection and piping connection

For the below equipment, the contractor will be responsible for providing and installing consumables and accessories, including:

- Terminals and Connections,
- Cable/Wiring Core Ferruling,
- Labels,
- Flexible Conduit,
- Cable Glands,
- Earthing and Bonding,
- Welding materials.
- All foundation bolts, anchorages, shim plates, wedges, nuts & washers, pads and mortar for installation
- Liner plates
- Flushing water and flushing equipment
- Seal tapes for piping or assembling of materials and equipment
- Grease, lubricants between contact part of busbars that will be fastened by bolts

The Contractor shall be responsible for the following activities:
- Provide any required temporary works including, but not limited to, the means of protection and the tools needed to properly manage and perform the different stages of work in the buildings and on site,
- Perform the complete installation (including the thermal insulation and the final coating if necessary),
- If required provide scaffolding
- arranging all the necessary handling material equipment,
- Perform final installation tests (mechanical & electrical completion) and verifications,
- Issue all necessary documentation for the works, such as Quality Plan. Health and Safety plan, Workface planning (Installation sequence and Level 4 Schedule) and the List of documents to be issued for the execution of the works.
- Issue the As-Built documents

- Provide support during commissioning phase with a minimum number of resources (as required).
- Activity for acquisition of permit to work (PTW) and administrative preparation of installation work

All above mentioned site works shall be performed by the Contractor within ITER Site at Saint Paul-lez-Durance in France.

3.1. PF CONVERTER UNITS AND TRANSFORMERS (LOT1)

Miscellaneous Components

Note that the below information are preliminary only. A more detailed description will be provided at Call for Tender stage.

Description	Install	Procure
Cables		
LV Power < 16mm^2	6 km	
I&C < 16 cores	50 km	
I&C > 16 cores	2 km	
Ethernet	1.5 km	
Fibre optic	12 km	
Cable Trays and Conduits		
Cable Trays	530 m	530 m
Supports for Cable Tray	164 pc	164 pc
Conduits	275 m	275 m

14 sets of PF converter units and Transformers

Figure 4 : Prototype of PF Converter

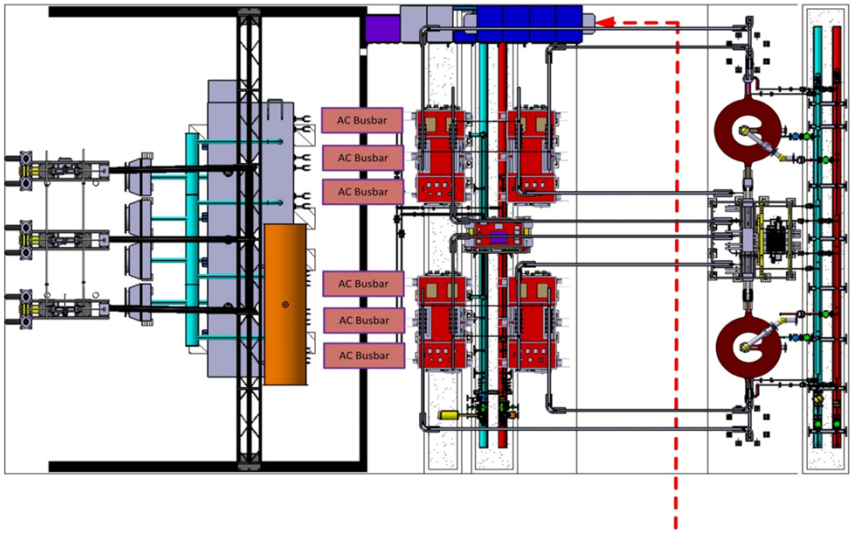


Figure 5 : Layout of PF Converter

Components	**Parameters**	**Dimension, (L×W×H, mm)**	**Weight(kg)**	**Quantities**
Surge Arrester	66 kV	1836 ×391 ×340	300	42
AC Disconnectror	66 kV / 1250 A	1150 ×1260 × 250	300	14
Converter Transformer	2×41 MVA, 16%; 66 kV / 1.05 kV	9488×5360×5710	98,500	14
AC Busbar	12 kV /2× 22.5 kA	3400 × 3035 × 1500	2,500	28

Over-voltage protection box	3020×500×520		400	28
Converter bridge	12 kV / 27.5 kA	3030×2300×3720	6,500	56
External bypass	12 kV /±55 kA, 1s	1700×996×3720	3,000	14
DC reactor	27.5 kA / 200 uH	2955×2576×3296	2,500	56
DC disconnector	2 kV / 55 kA	1497×530×889	500	28
DC earth switch	12 kV	778×446×491	55	14
I&C control and power distribution cubicles	600×800×2000		250	62
Current transducer	30 kA	660×660×110	100	70
Current transducer	60 kA	660×660×110	100	14
DC busbar	30 kA	110000×200×60	3,600	14

1 Dummy Load

Installation of one Dummy load outside Building B33

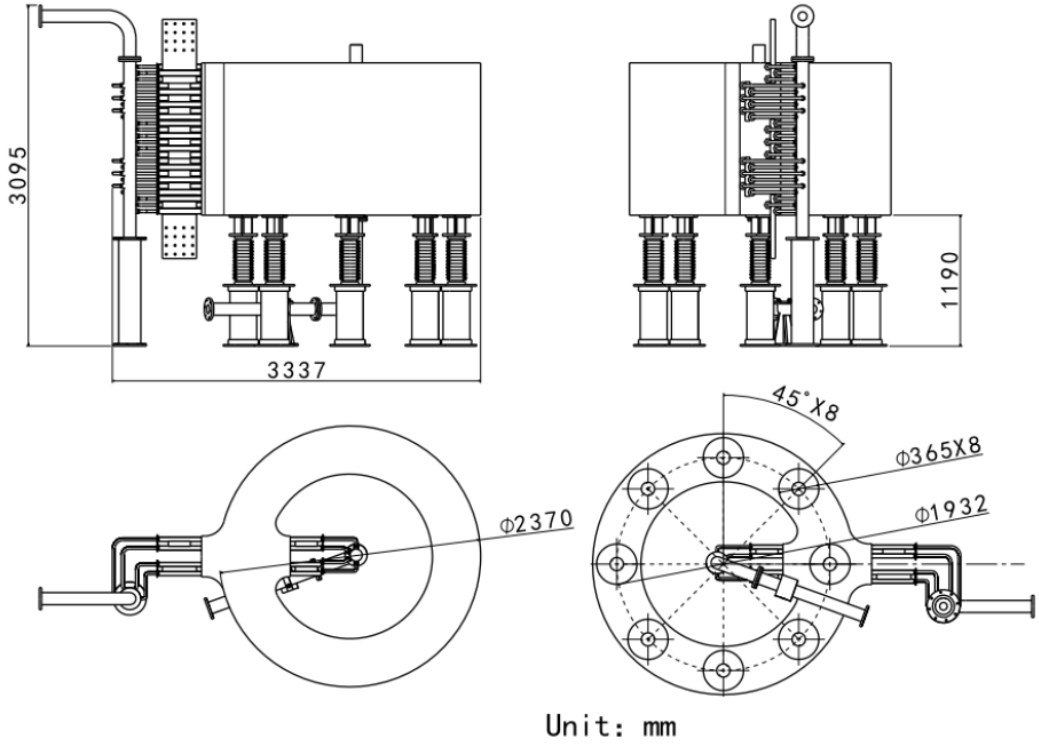


Figure 6 : Layout of Type 1 Dummy Load

Components	**Parameters**	**Dimension, (L×W×H, mm)**	**Weight(kg)**	**Quantities**
Dummy load	12 kV/6.73 mH	3337×2370×3095	10,000	1

3.2. TF,CS,CC and VS CONVERTERS (LOT2)

Miscellaneous Components

Note that the below information are preliminary only. A more detailed description will be provided at Call for Tender stage.

Description	Install	Procure
Cables		
LV Power < 16mm^2	6 km	
I&C < 16 cores	50 km	
I&C > 16 cores	2 km	
Ethernet	1.5 km	
Fibre optic	12 km	
Cable Trays and Conduits		
Cable Trays	540 m	540 m
Supports for Cable Tray	164 pc	164 pc
Conduits	290 m	290 m

2 VS Converter

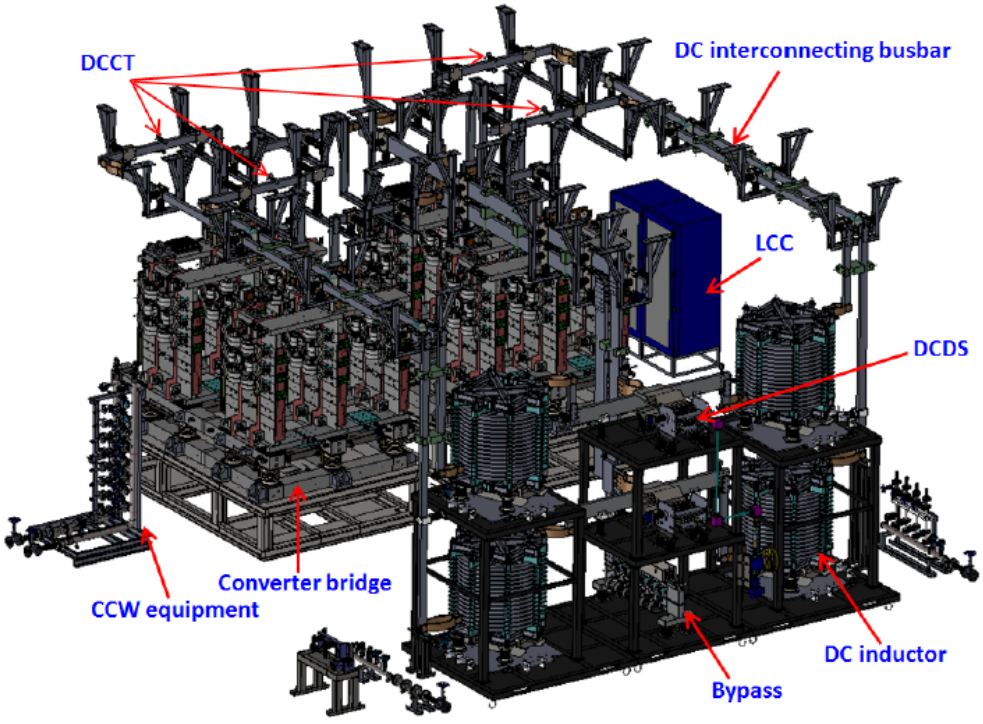
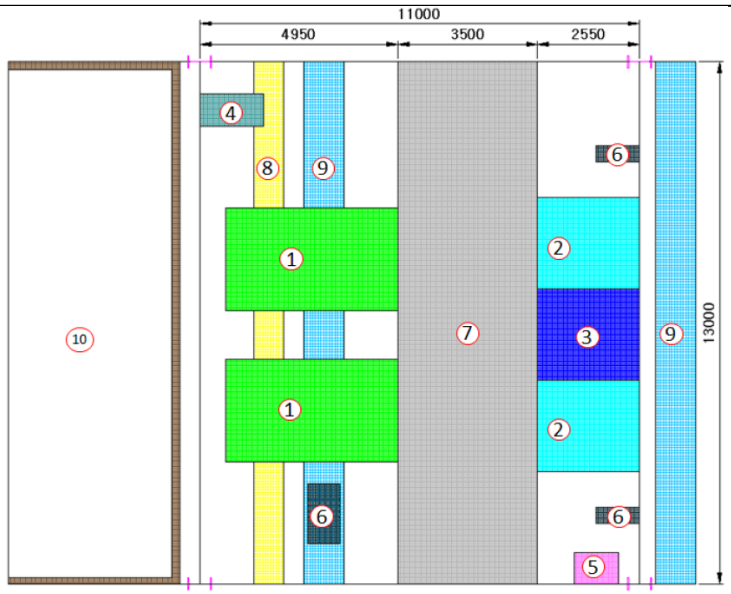


Figure 7 : Layout of VS Converter Unit



①: Converter bridge, ②: DC inductor, ③: Bypass & DCDS, ④: LCC, ⑤: DCES
⑥: CCW equipment, ⑦: Corridor space, ⑧: Cable Trench, ⑨: CCW Trench
⑩: Transformer Area

Figure 8 : Plan view of VS Converter Unit

Components	Parameters	Dimension, (L×W×H, mm)	Weight, (kg)	Quantities
Converter bridge	1.05 kV/22.5 kA	4,100×2,800×3,400	14,000	4
External bypass	1.4 kV/22.5 kA, 1s	2,250×570×900	450	2
DC Inductor	1.4 kV/11.25 kA/250 uH	1,680×1,550×2,000	1,600	8
DC Inductor Structure		2,550×2,550×4,540	1,300	4
DCDS (DC Disconnector Switch)	2 kV/25 kA	1160×680×800	450	4
DCDS Structure		2,550×2,000×3,500	1,950	2
I&C control and power distribution cubicles		800×800×2700	250	5
DCES (DC Earthing Switch)	12kV/400A/96kA$_{peak}$	902×356×385	30	2
DC Interconnecting busbar	33 kA	11600×114×60	32000	2

9 CC Converter (6CCUL + 3 CCS Converter)

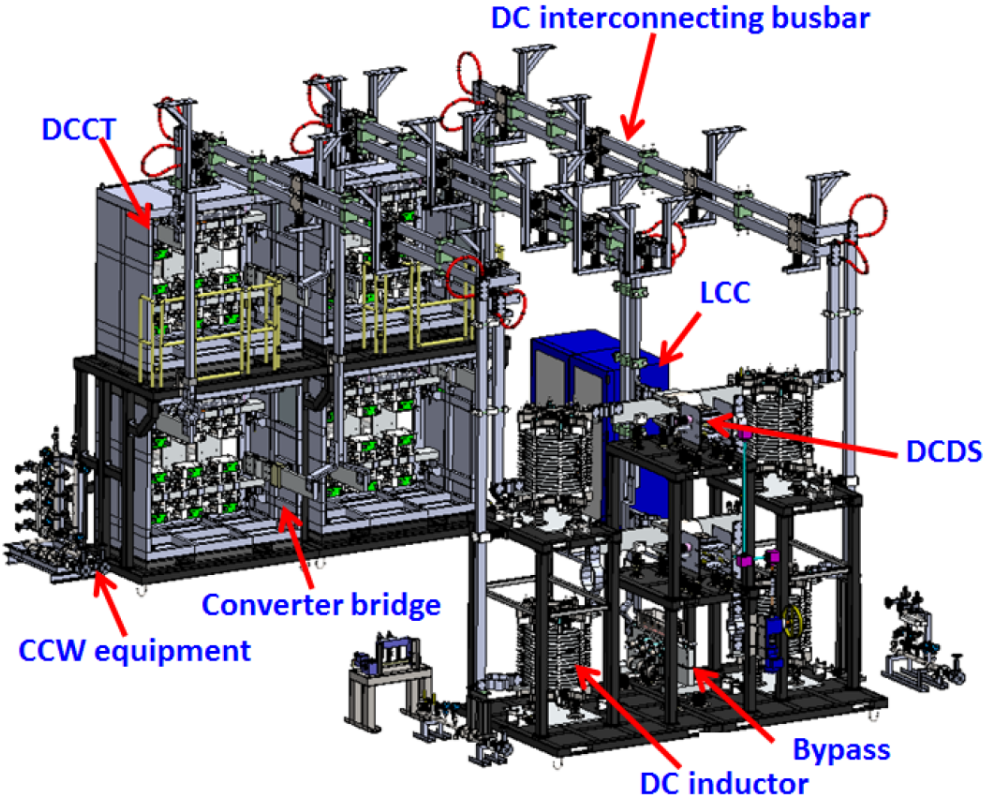
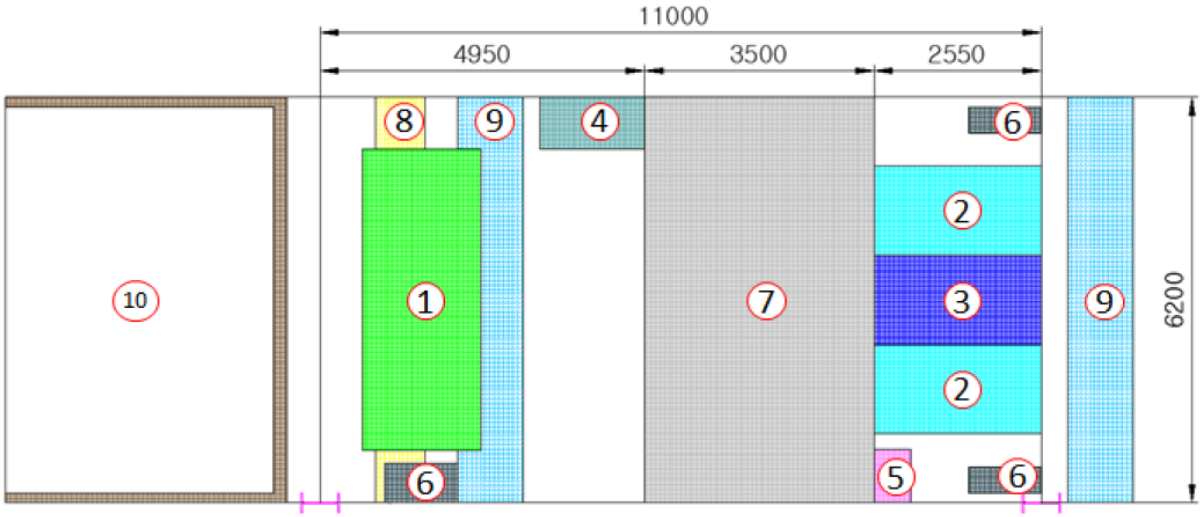


Figure 9: Layout of CC converter Unit



①: Converter bridge, ②: DC inductor, ③: Bypass & DCDS, ④: LCC, ⑤: DCES
⑥: CCW equipment, ⑦: Corridor space, ⑧: Cable Trench, ⑨: CCW Trench
⑩: Transformer Area

Figure 10 : Plan view of CC converter Unit

6 CCU/L

Components	Parameters	Dimension, (L×W×H, mm)	Weight, (kg)	Quantities

Converter bridge	0.085 kV/10 kA	2000×1600×1950	6,000	24
Rack structure of Converter bridge		4700×1885×2250	1,350	6
External bypass	0.13 kV/10 kA, 1s	1485×540×910	280	6
DC Inductor	0.13 kV/5 kA/80 uH	1250×1000×1275	450	24
DC Inductor Structure		2200×2400×2100	700	12
DCDS (DC Disconnector Switch)	2 kV/12 kA	966×560×670	127	12
DCDS Structure		1220×1560×2900	500	6
I&C control and power distribution cubicles		800×800×2700	300	12
DCES (DC Earthing Switch)	3.6kV/400A/50kA$_{peak}$	727×356×385	25	6
DC Interconnecting busbar	33 kA	11600×114×60	3030	6

3 CCS

Components	**Parameters**	**Dimension, (L×W×H, mm)**	**Weight, (kg)**	**Quantities**
Converter bridge	0.3 kV / 10 kA	2000×1600×1950	6,000	12
Rack structure of Converter bridge		4700×1885×2250	1,350	3
External bypass	0.44 kV/10 kA, 1s	1485×540×910	280	3
DC Inductor	0.44 kV/5 kA/120 uH	1250×1000×1550	600	12
DC Inductor Structure		2200×2400×2150	730	6
DCDS (DC Disconnector Switch)	2 kV / 12 kA	966×560×670	127	6
DCDS Structure		1220×1560×2900	500	3
I&C control and power distribution cubicles		800×800×2700	300	7
DCES (DC Earthing Switch)	3.6kV/400A/50kA$_{peak}$	727×356×385	25	3
DC Interconnecting busbar	33 kA	11600×114×60	3030	3

6 CS Converter

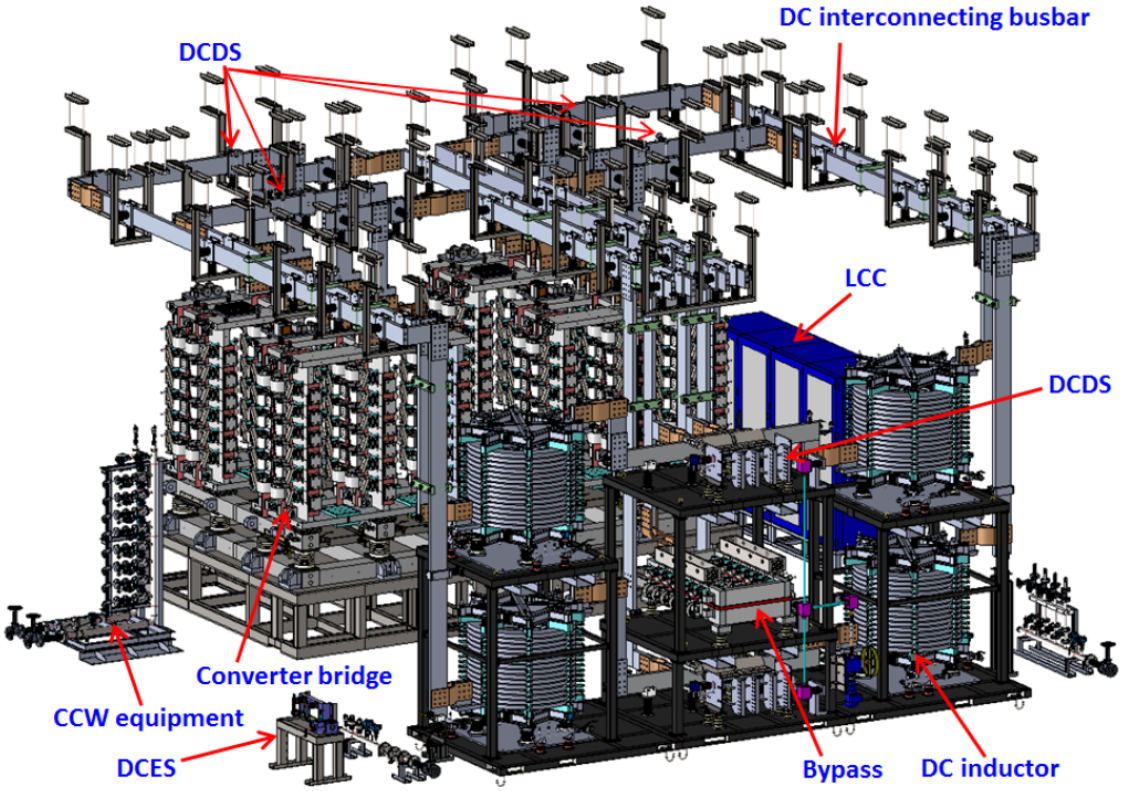


Figure 11 : Layout of CS converter Unit

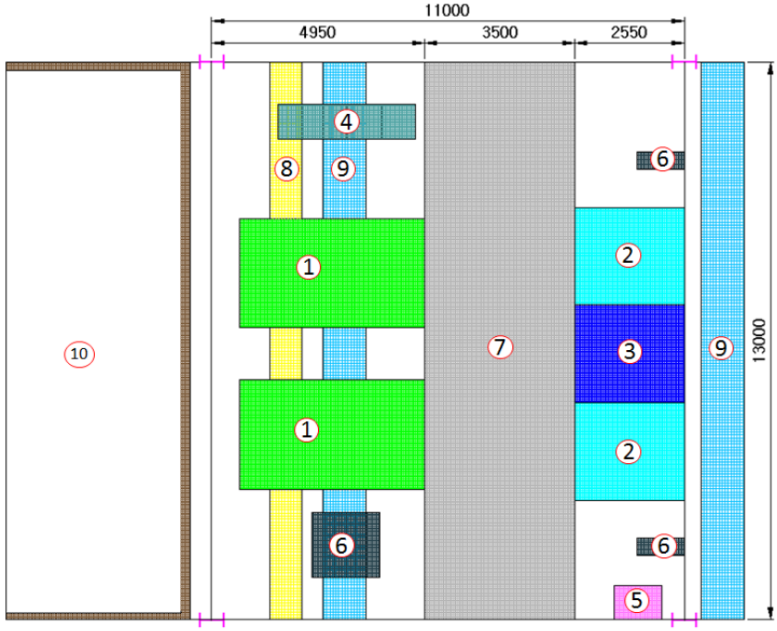


Figure 12 : Plan view of CS converter Unit

Components	Parameters	Dimension, (L×W×H, mm)	Weight(kg)	Quantities
Converter bridge	1.05 kV/45 kA	4200×3050×4050	17,000	12
External bypass	1.4 kV/45 kA, 1s	2350×1420×940	970	6
DC Inductor	1.4 kV/22.5 kA/200 uH	1880×1450×2050	2580	24
DC Inductor Structure		2550×2990×2670	1350	12
DCDS (DC Disconnector Switch)	2 kV/51 kA	1550×680×800	470	12
DCDS Structure		2550×2250×3000	1250	6
I&C control and power distribution cubicles		800×800×2700	300	13
DCES (DC Earthing Switch)	12kV/400A/96kA$_{peak}$	902×356×385	30	6
DC Interconnecting busbar	66 kA	11600×228×60	6700	6

1 TF Converter

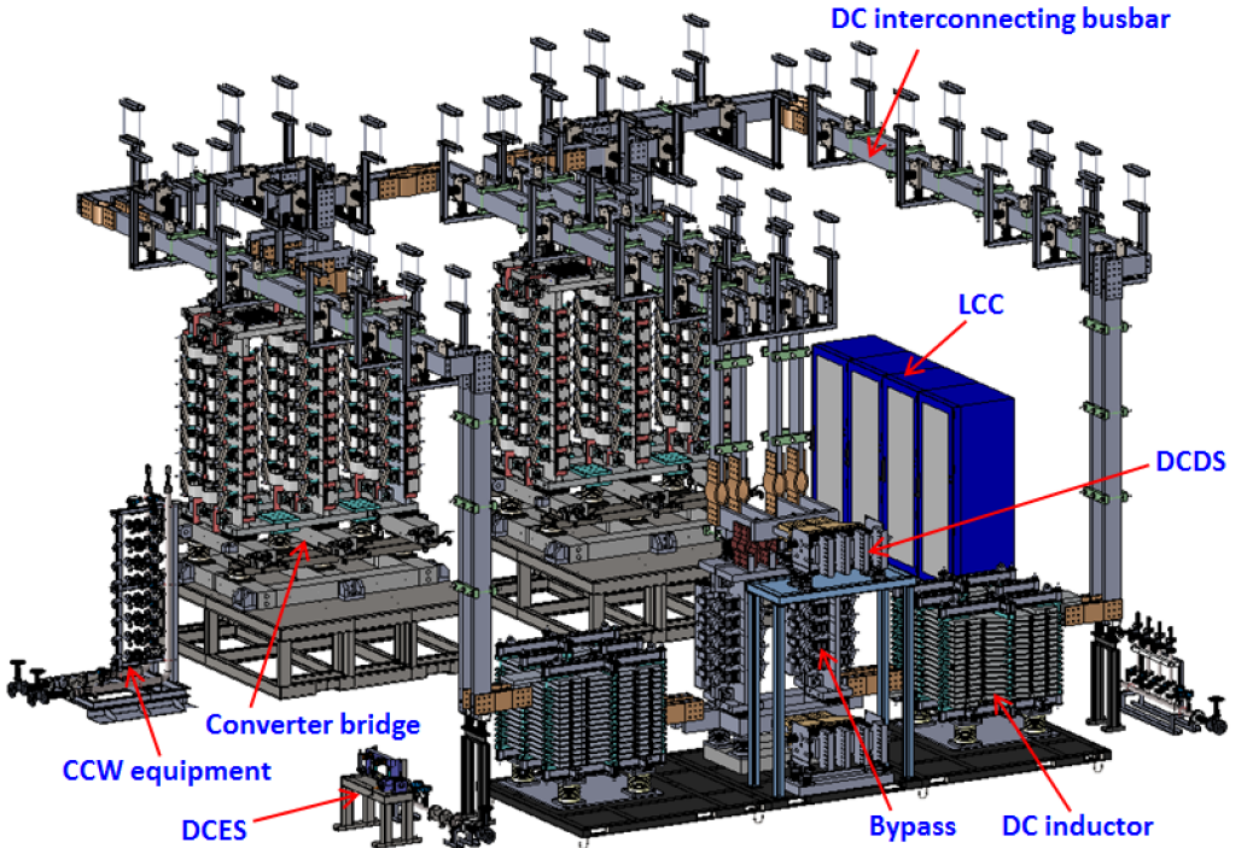
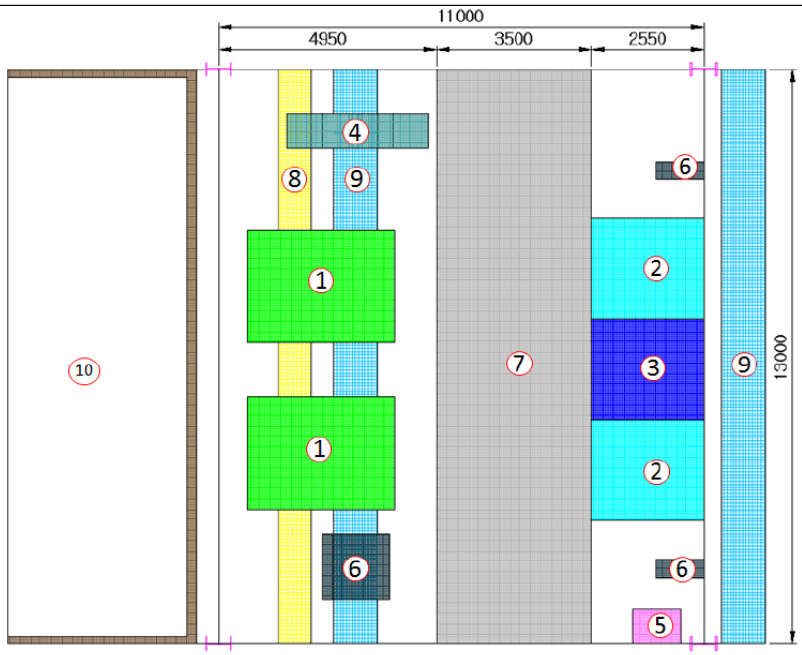


Figure 13 : Layout of TF converter Unit



①: Converter bridge, ②: DC inductor, ③: Bypass & DCDS, ④: LCC, ⑤: DCES
⑥: CCW equipment, ⑦: Corridor space, ⑧: Cable Trench, ⑨: CCW Trench
⑩: Transformer Area

Figure 14 : Plan view of TF converter Unit

Components	Parameters	Dimension, (L×W×H, mm)	Weight(kg)	Quantities
Converter bridge	0.65 kV/68 kA	3400×3300×4350	10,000	2
External bypass	0.9 kV/68 kA, 1s	2400×1550×3100	3000	1
DC Inductor	0.9 kV/34 kA/115 uH	2300×1600×1720	3700	2
DC Inductor Structure		2550×2550×115	500	2
DCDS (DC Disconnector Switch)	2 kV/72 kA	1720×750×810	530	2
DCDS Structure		2240×2700×2600	900	1
I&C control and power distribution cubicles		800×800×2700	300	4
DCES (DC Earthing Switch)	12kV/400A/96kA$_{peak}$	902×356×385	30	1
DC Interconnecting busbar	132 kA	11600×228×60	6700	1

1 Dummy Load

Installation of one Dummy load outside Building B32

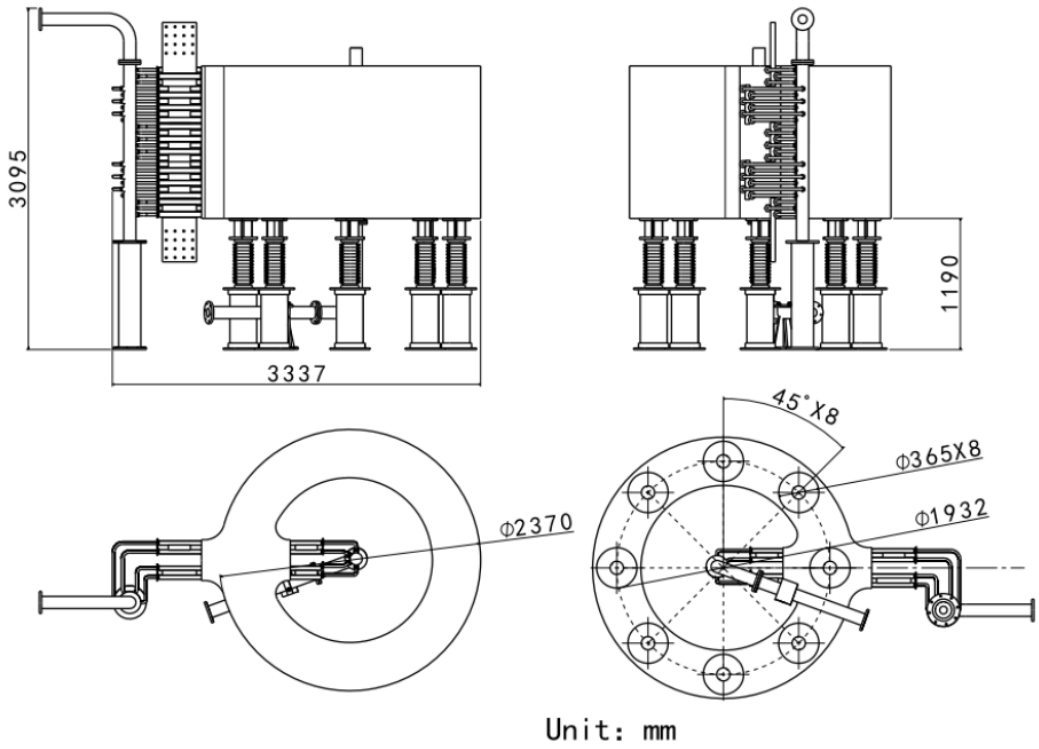


Figure 15 : Layout of Type 1 Dummy Load

Components	Parameters	Dimension, (L×W×H, mm)	Weight(kg)	Quantities
Dummy load	12 kV/6.73 mH	3337×2370×3095	10,000	1

1 Master Control System

Installation of one Master Control System in MCS room where is located inside Building B33

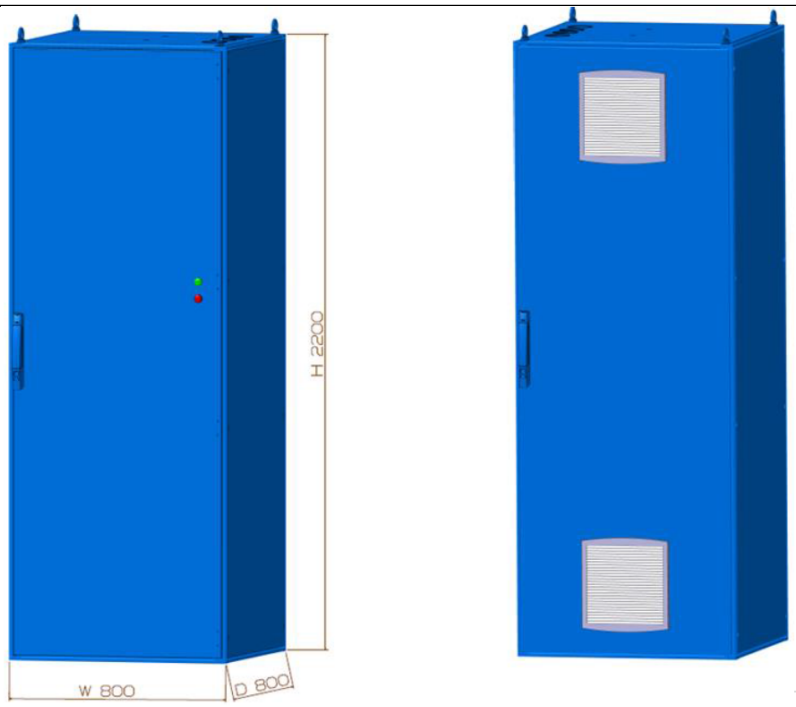
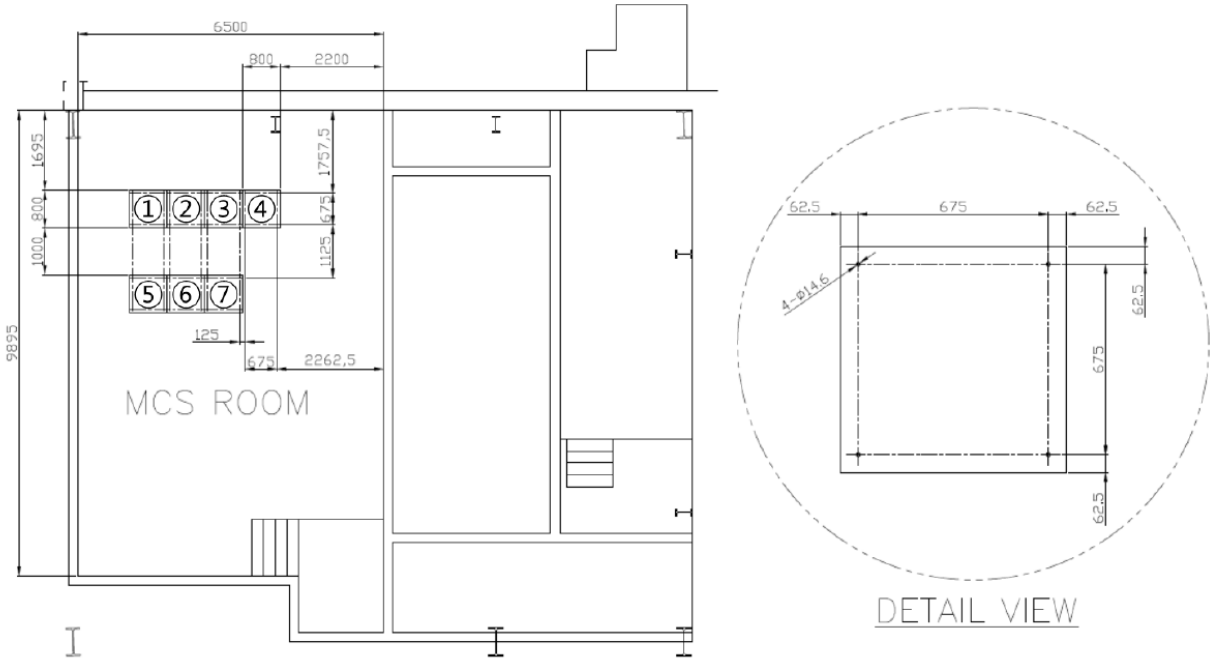


Figure 16: Layout of MCS Cubicle



①: 41MC00-CU-1001, ②: 41MC00-CU-2001, ③ : 41MC00-CU-1003, ④ : 41MC00-CU-2003,
⑤ : 41MC00-CU-1002, ⑥ : 41MC00-CU-2002, ⑦ : 41MC00-CU-3002

Figure 17: Layout of MCS room and Plan view of MCS Cubicles

Components	Dimension, (L×W×H, mm)	Weight(kg)	Quantities
TFPS Conventional Cubicle (41MC00-CU-1001)	800×800×22000	400	1
TFPS Interlock Cubicle (41MC00-CU-2001)	800×800×22000	300	1

CCPS Conventional Cubicle (41MC00-CU-1003)	800×800×22000	500	1
CCPS Interlock Cubicle (41MC00-CU-2003)	800×800×22000	400	1
PFCS Conventional Cubicle (41MC00-CU-1002)	800×800×22000	500	1
PFCS Interlock Cubicle (41MC00-CU-2002)	800×800×22000	400	1
PFCS Safety Cubicle (41MC00-CU-3002)	800×800×22000	300	1

3.3. RPC and HF (LOT3)

Three sets of RPC&HF are located at building 38# and area 39# in vertical, where we have circular transportation corridor around area 39, horizontal transportation corridor in between 2nd and 3rd set of RPC&HF, vertical maintenance corridor in between TCR banks and harmonic filter banks.

- The size of building 38 is 58.5 m×15m;
- The size of Area 39 is 124.09 m×74m;

Miscellaneous Components

Note that the below information are preliminary only. A more detailed description will be provided at Call for Tender stage.

Description	Install	Procure
Cables		
66kV Cables	4 km	
LV Power < 16mm^2	2 km	
I&C < 16 cores	4 km	
I&C > 16 cores	1 km	
Ethernet	0.5 km	
Fibre optic	5 km	
Cable Trays and Conduits		
Cable Trays	120 m	120 m
Supports for Cable Tray	58 pc	58 pc
Conduits	170 m	170 m

Activity in Building 38

Main activities to be performed in building 38 are the installation of the single-phase thyristor valve and the main Control cubicle. In addition the Contractor will be performing cable pulling and termination.

Each group will be installed in building 38, including the relative control cubicle.

Components	Parameters	Dimension, (L×W×H, mm)	Weight(kg)	Quantities
Single-phase Thyristor Valve	66kV/ 1410A	3408×1252×2806	2,100	9
I&C control and power distribution cubicles	800×800×2200		240-500	19
Wall busing	2210 L		220 kg	18

In addition to the above main components, the following components will be installed in building 38.

- Thyristor valve Fence
- Cooling water pipes between Thyristors
- Accessories

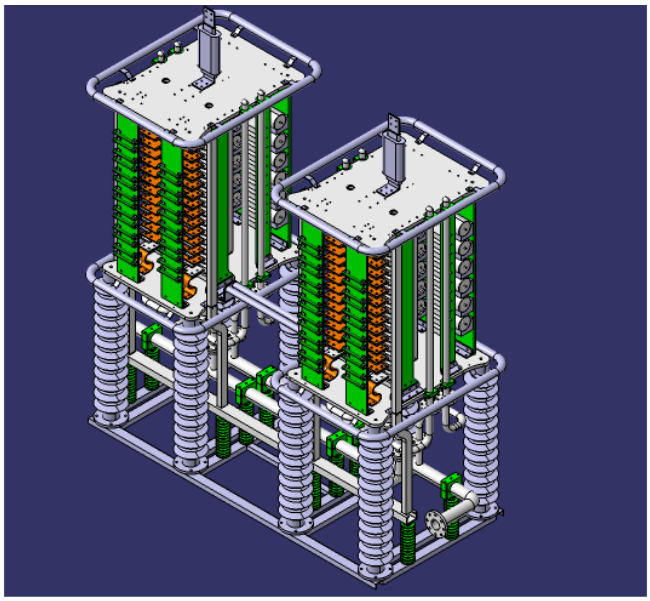


Figure 18: Structure of single-phase valve group

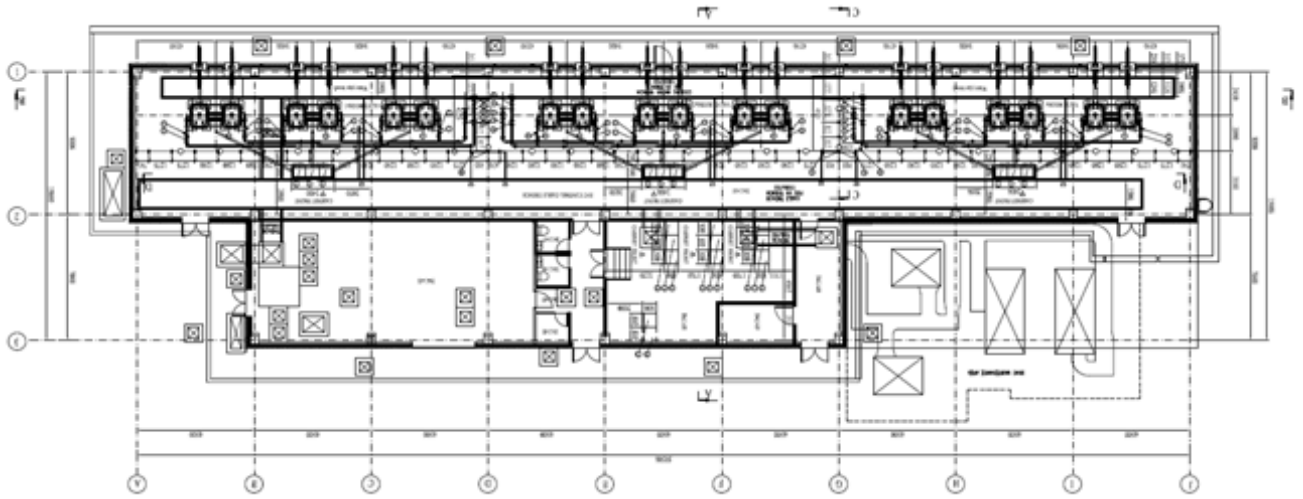


Figure 19: Three sets of valve group room plane layout

Activity in Area 39

Main activities to be performed in Area 39 are the installation of the Thyristor Controlled Reactor valve, the Harmonic Filter (H3, H5, H7, H11, H13, H23). In addition the Contractor will be performing cable pulling and termination.

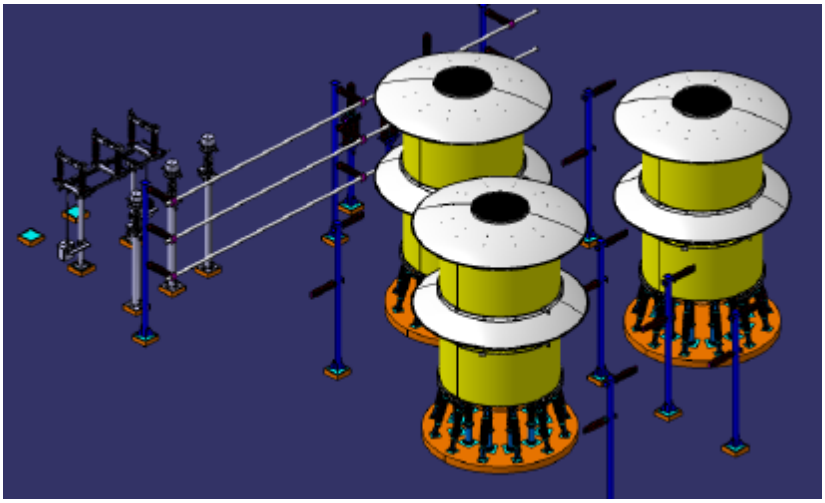


Figure 20: TCR reactor outline diagram

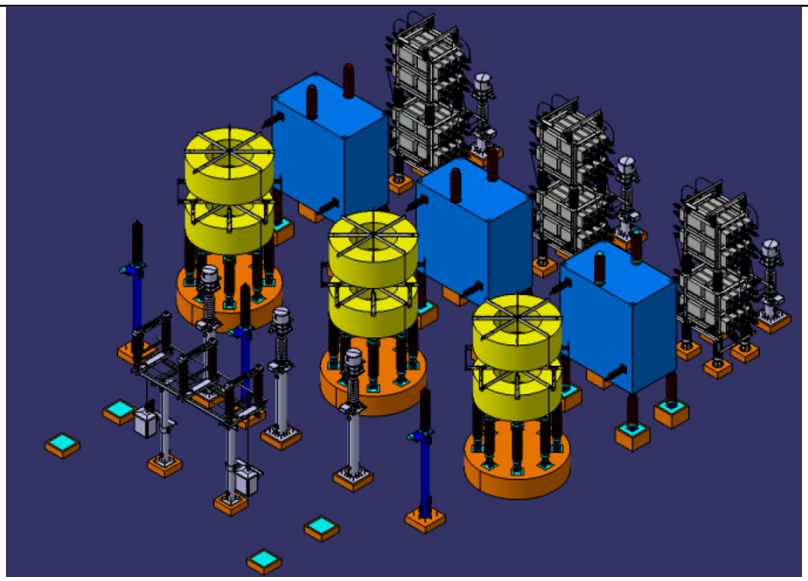


Figure 21: HF assembly diagram

Components	Parameters	Dimension (mm)	Weight(kg)	Quantities
Thyristor Controlled Reactor	66kV / 1326A	3650 (diameter)×8394 (height)	24,725	9
H3 Filter reactor	66kV / 290A	1870 (diameter)× 3981 (height)	3,453	9
H3 Filter Capacitor	55.2 kV / 48000kVar	2147 L×1140 W×4468 H	3,800	9
H3 Filter Resistor	66kV / 1000Ω	2360L ×1360 W ×3690	3,200	9
H5 Filter reactor	66kV/870A	2140 (diameter)× 3588 (height)	3,899	9
H5 Filter Capacitor	55.2kV / 144000kVar	2160 L×4302 W×4468 H	10,000	9
H7 Filter reactor	66kV/580A	1575 (diameter)× 3981 (height)	2,263	9
H7 Filter Capacitor	55.2kV/96000kVar	2202 L×2951 W×4518 H	6,200	9
H11 Filter reactor	66kV/580A	1490 (diameter)× 3765 (height)	1,723	9
H11 Filter Capacitor	55.2kV/96000kVar	2235 L×2951 W×4518 H	6,200	9
H13 Filter reactor	66kV/440A	1280 (diameter)× 3541 (height)	1,059	9
H13 Filter Capacitor	54kV/72000kVar	2320 L×2470 W×4468 H	5,000	9

H23 Filter reactor	66kV/290A	1385 (diameter)× 3501 (height)	567	9
H23 Filter Capacitor	54kV/48000kVar	2302 L×1990 W×4468 H	3,800	9
H23 Filter Resistor	66kV / 17.5Ω	2360L ×1360 W ×3690	3,200	9

4. Interfaces with other companies

There shall be other contractors working on the ITER site around the Buildings and also inside the Buildings involved in these installation activities.

To manage the coactivity and the Installation schedule IO is currently working with a Construction Management-as Agent (CMA). The CMA shall oversee these tasks on behalf of IO-CT :

- Site coordination (including permit to work)
- Material management,
- Work supervision, quality control, record keeping
- Management of installation Completion Activities.

The CMA acts as the Engineer for this Works Contract under the FIDIC “Red Book”.

5. Timetable

The tentative timetable is as follows:

Issue of Pre-Qualification	March 2018
Invitation to Tender	May 2018
Tender Submission	June 2018
Contract Award	September 2018
Start of the Works	October 2018

The contract duration is estimated to be between 24 and 30 months for the whole of the installation works, including testing and preparation of the final documentation.

6. Nuclear and Quality Requirements

The ITER Organization is the nuclear operator of the ITER nuclear fusion facility (INB 174) under French nuclear law.

The Contractor will have to provide an evidence of implemented Quality Assurance System required for installing of nuclear components and shall comply with the French Order of 7th February 2012 establishing the general rules for basic nuclear installations.

No Protection Important Components related to Nuclear Safety **are to be installed** under this contract.

The Protection Important Activity (PIA) list to be performed during contract implementation will be given in the Call for Tender package.