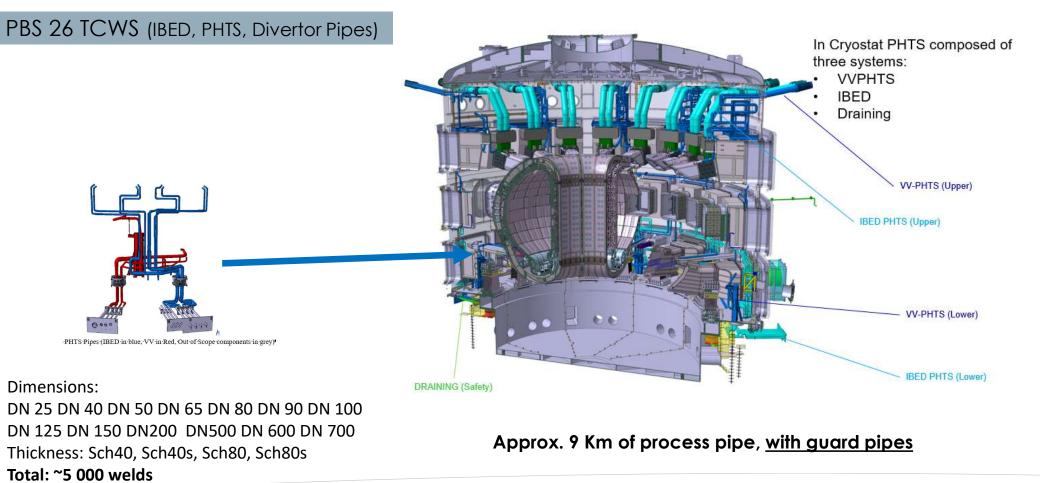


Contents

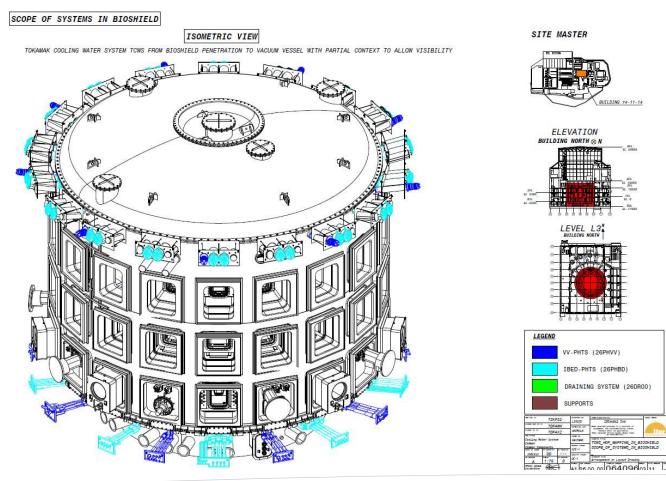
- 1. In Cryostat TCWS piping system overview
- 2. Construction Work Package
- 3. CWP Install PHTS Early Works Pipework
- 4. CWP Install PHTS Lower and Equatorial Pipework
- 5. CWP Install Upper IBED Pipework
- 6. CWP Install Upper VV PHTS Pipework
- 7. Scope of procurement





In Cryostat TCWS piping installation Overview of Scope of Work





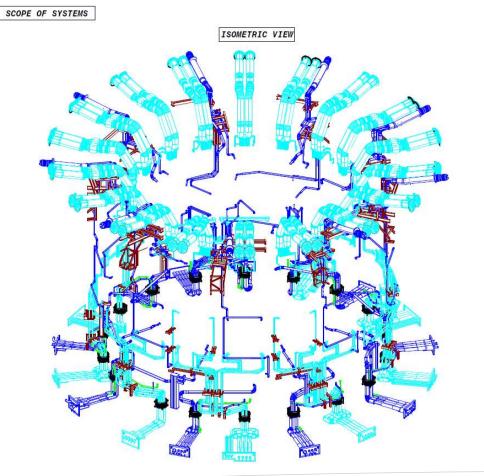
In Cryostat TCWS piping installation Overview of Scope of Work



4

BUILDING 74-11-14

or Leyout Drewing





In Cryostat TCWS piping installation Overview of Scope of Work



Design pressure	5 Mpa				
Design Temperature	270°C				
PE/NPE	Exception				
Safety	SIC-1				
Quality	QC-1				
Vacuum	VQC-2A/VQC-3A				
Tritium	2A				
Cryogenic	NA				
Seismic	SC1				



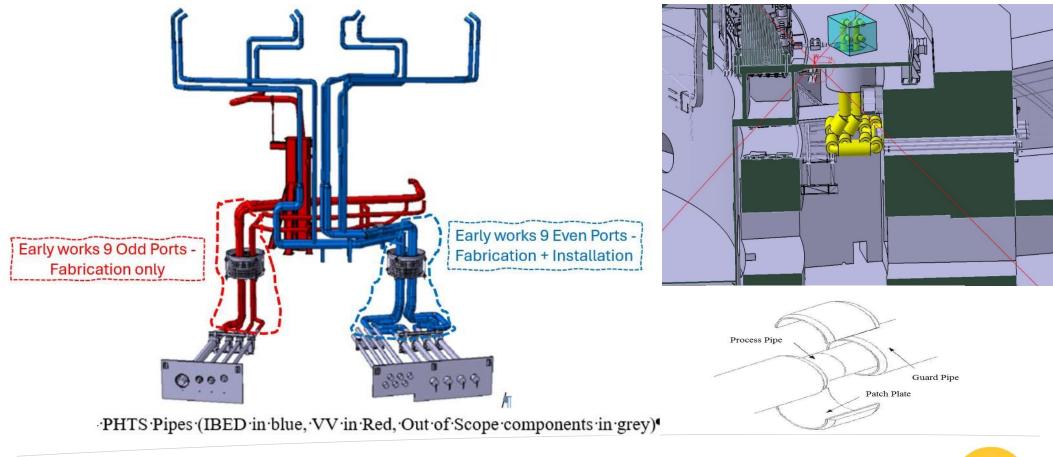
2. Construction Work Package

- 1. The In-Cryostat TCWS scope consists of approximately 9000 linear meters of pipe separated into 37 CWPs.
- 2. These CWPs will be instructed to the Contractor in four main groups as below table based on the fluid systems and location in the Tokamak Pit.
- 3. The fabrication (MWP) is need for each of the installation group (CWP).
- 4. All piping in this scope is to be double walled except for the upper IBED multi-process bundles scope.

CWP Description	Description	Number	Installation
		of CWPs	Group
Install PHTS Early Works Pipework	Captive pipe in lower cryostat	1	1
Install PHTS Lower and Equatorial Pipework	IBED, VV-PHTS, and DR system piping in lower and	Q	2
	equatorial cryostat	9	
Install Upper IBED Pipework	IBED bundles in upper cryostat	18	3
Install Upper VV PHTS Pipework	VV-PHTS system in upper cryostat	9	3



CWP -TCWS Lower section Early works (1) – Installation from Feb.2028 to May. 2028



In Cryostat TCWS piping installation Overview of Scope of Work

ISOMETRIC VIEW SCALE 1 5:10 ISOMETRIC VIEW 26PHVV-PI-2612 26PHBD-P1-1760 4 x IBED NOZZLI Ø Ø 0.3 B 26PHVV-PI-241 26PHBD - PI - 186 26PHVV-PI-2692 W-PI-2312 26PHVV - PI - 249 26PHBD - PI - 01 260R00-PI-004 26PHBD - PI - 186 26PHBD - PI - 1761 WV-PI-2392 26PHBD - P1 - 02 26PHVV-PI-004 26PHVV-PI-2411 SPHED-PI-1768 26PHBD-PI-026 PHBD-P1-1660 26PHBD-PI-1 26DR00-PI-1143 26PH8D-PI-1868 26PHBD-PI-166 26PHBD-PI-0268 HBD-PI-0161 26PHVV-PI-1142 26PHBD-PI-156 26PHVV - PI -1 × DRAIN STU 26PH8D-PI-0168 26PHVV-PI-261 HBD-PI-1769 1. 2 26PHVV-PI-242 26PHVV-PI-249 26PH80-PI-1668 26PHVV-PI-2621 D-PI-1568 SECTOR 18 6PHVV-PI-238 26PHVV-PI-242 -PI-0169 26PHBD - PI - 1669 SECTOR 01 VACUUM FLANGE-IBED PHTS SECTOR 17 26PHBD - PI - 036 26PHDB-PI-026 26PHVV-PI-268 SECTOR 02 THIS DRAVING IS USED FOR FOLLOVING VACCCUM FLANGE 26PHBD-PI-036 26PHVV-PI-2321 59.6 227.5 PHVV-PI-2482 260000-SEP-0008 26PHVV-PI-2622 26PHBD - PI SECTOR 16 SECTOR 03 26DR00-PI-1141 A-A ⊙ 15.31° 260000-SEP-0006 26DR00-PI-1144 VACUUM FLANGES + BELLOWS 26PHVV-PI-292 26PHVV-PI-2481 4x Ø 168,3 260000-SEP-0005 \triangle 0.5 A 260000-SEP-0004 0-SEP-0022 260000-JOM-00 26PHVV - PI - 272 4x Ø 154.1 5 x45' (Typ.) SECTOR 15 5 x45* 260000-SEP-0003 RLO (Typ.) 260000-SEP-0002 6PHBD - PI - 0366 VACUUM FLANGE TAG SECTOR 04 26PHBD-PI-1260 weight 135.6 kg SECTOR 14 26PHBD - PI - 1361 -- 10M-00 26PHVV-PI-2921 26PHVV-PI-233 _5 x45* JOM-C 26PHBD - PI - 1469 26PHVV-PI-2632 26PH8D-PI-1468 26PHVV-PI-2432, 304L to F304 SECTOR 05 Â Ø 13,8 26.07.2020 5 x45'(Typ.) 26PHED - PI - 1368 SECTOR 13 26PHVV-PI-2331 0 21 Resider ET A È HVV-PI-2432 26PHVV-PI-2932 SECTOR 06 PI-2472 26PHVV-PI-23 TYPICAL SPACER FOR 26PHVV-PI-2631 SECTOR 12 26PHVV-PI-2672 26PHVV-PI-2937 DN 65 - SCH40S PROCESS PIPE 260R00-PI-1145 260R00-PI-1149 26PHVV-PI-2735 DN 100 - SCH40S GUARD PIPE SECTOR 07 26PHVV-P1-2732 26PHVV-P1-2738 26PHVV-PI-2471 26PHVV-P1-2931 26PHVV-PI-2671 26PHVV-PI-2341 SECTOR 11 FRONT VIEW 26PHBD-PI 26PHVV-P1-2371 26PHVV-P1-273 PHVV-PI-2362 26PHVV-PI-2442 SECTOR 08 SECTOR 10 IH 26PMBD-P1-1160 26PHVV-P1-273 260R00-PI-0046 SPHVV-PI-2662 SECTOR 09 DETAIL A 26PHVV-PI-2737 SPHVV-PI-2462 26PHBD-PI-09 26PHVV-PI-293 26PHBD - PI - 0860 BD-PT-1080 26PHBD - PI - 1269 26PHVV-P1-264 V-PI-2352 26PHBD - PI - 0861 00-PI-0048 26PHBD-PI-1168 D PEPHED-PI-09 6DR00-PI-0047 PHBD-PI-1169 26PHVV-PI-234 PHBD - PI - 1060 DB00-PT-114 26PHVV-PI-2452 6DR00-PI-1148 26PHVV - PI - 2652 26PHVV-PI-2461 26PHVV-PI-244 WV-PI-2451 26PHBD-P1-086 26PHVV-PI-2351 PHVV-P1-2661 R00-PI-1147 26PHBD - PI - 0 A HBD-PI-106 26PHVV-PI-2651 D 26PHRD . PI - 0969 mater Sector PHRD PT-1068 Lug+Gap 26PHBD-PI-096

CWP -TCWS Lower section Early works (1) – Installation from Feb.2028 to May. 2028

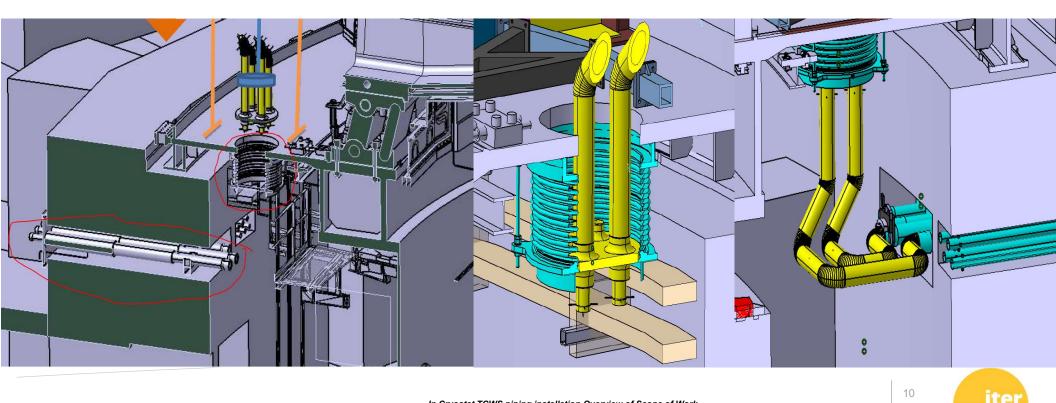
In Cryostat TCWS piping installation Overview of Scope of Work

SECTION A-A



CWP -TCWS Lower section Early works (1) – Installation from Feb.2028 to May. 2028

Interface with A0 scope installed by the other Contractor in B11 @ B2 Crown area. Interface with 18 Bellows installed by the other Contractor in B11 Cryostat Base.



CWP -TCWS Lower section Early works (1) – Installation from Feb.2028 to May. 2028

Spacers – 140 no. 50 Kg.

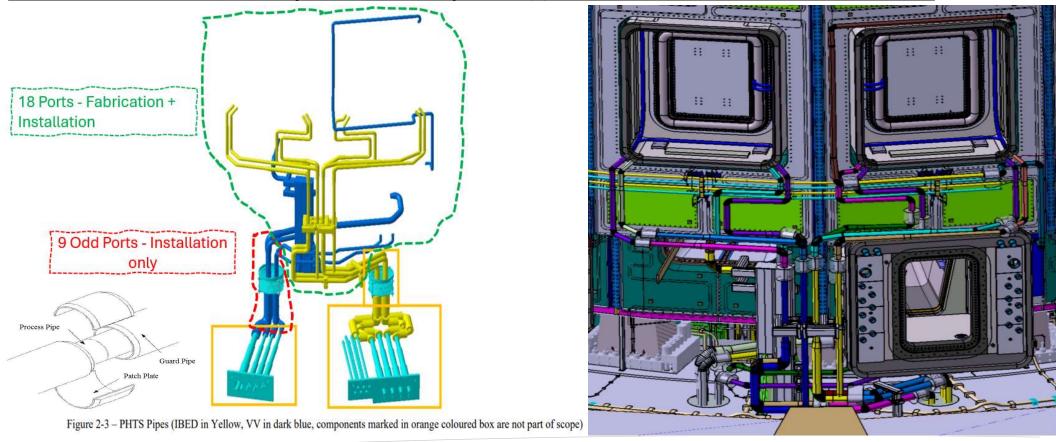
Vacuum plates – 18 no. with spools fabrication but only install 9 no. with spools

System	Diameter (DN)	Thickness (Sch.)	Process/Guard	Length (m)	Fittings (no.)	Fabrication/Installation
DR	65	S-40S	Process	30	26	Fabrication
DR	100	S-40S	Guard	3	0	Fabrication
DR	125	S-40S	Guard	15	41	Fabrication
DR	150	S-40S	Guard	5	12	Fabrication
VVPHTS	65	S-40S	Process	90	20	Fabrication
VVPHTS	150	S-40S	Process	36	10	Fabrication
VVPHTS	100	S-40S	Guard	50	20	Fabrication
VVPHTS	125	S-40S	Guard	7	67	Fabrication
VVPHTS	150	S-40S	Guard	12	9	Fabrication
VVPHTS	200	S-20	Guard	23	17	Fabrication
VVPHTS	250	S-40S	Guard	2	19	Fabrication
IBED	100	S-40S	Process	111	166	Fabrication+Installation
IBED	150	S-80S	Guard	102	166	Fabrication+Installation
1						

In Cryostat TCWS piping installation Overview of Scope of Work



CWP - Install PHTS Lower & Equatorial Ports Pipework (9) – Installation from Oct. 2028 to Jul. 2030

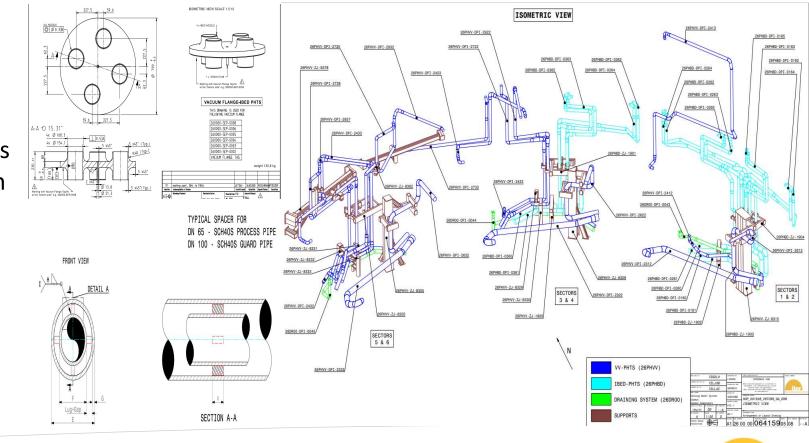


CWP - Install PHTS Lower & Equatorial Ports Pipework (9) – Installation from Oct. 2028 to Jul. 2030

The Isometric view is for pipework #1 to #6.

The Isometric view for pipework #7 to #12 has similar configuration in the relative sectors.

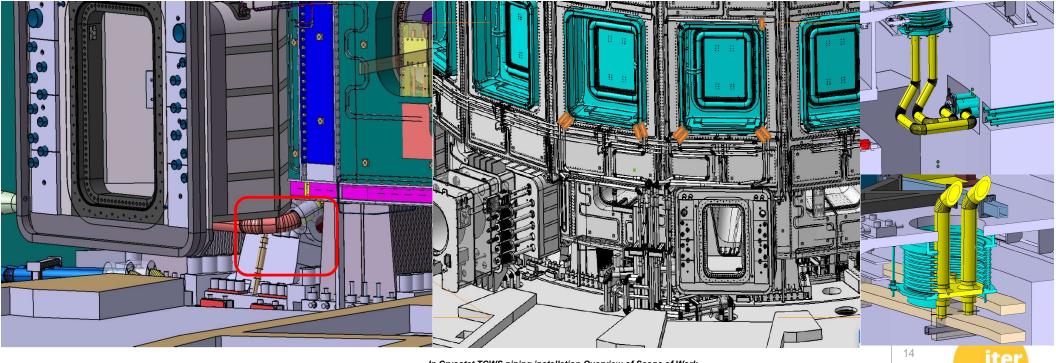
The Isometric view for pipework #13 to #18 has similar configuration in the relative sectors.



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CWP - Install PHTS Lower & Equatorial Ports Pipework (9) – Installation from Oct. 2028 to Jul. 2030

Interface with vacuum vessel installed by the other Contractor in B11 Cryostat @ L1 and L2. Interface with 9 Bellows installed by the other Contractor in B11 Cryostat Base. Interface with A0 scope installed by the other Contractor in B11 @ B2 Crown area.



<u>CWP - Install PHTS Lower & Equatorial Ports Pipework (9) – Installation from Oct. 2028 to Jul. 2030</u>

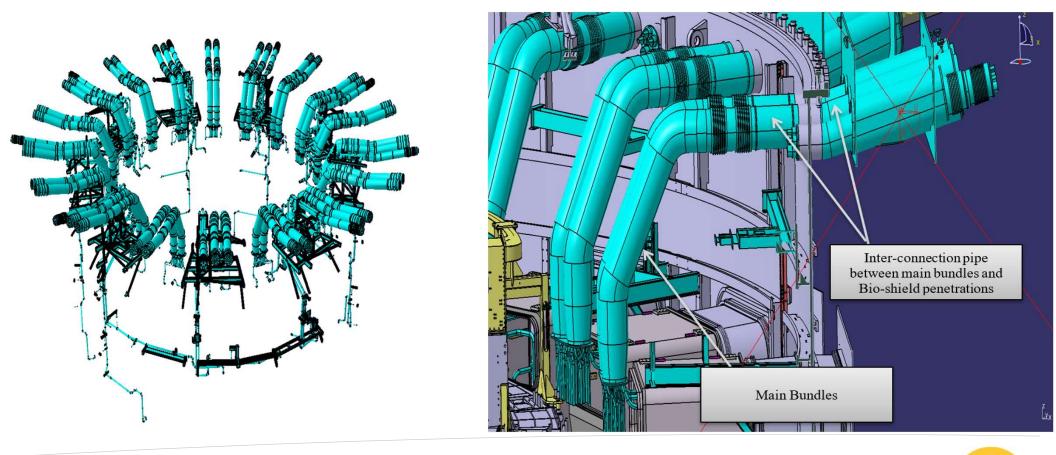
Supports include spacers – 26000 Kg. Vacuum plates – Install 9 no. with spools.

	System	Diameter (DN)	Thickness (Sch.)	Process/Guard	Length (m)	Fittings (no.)	Fabrication/Installation
	DR	65	S-40S	Process	30	26	Installation
	DR	100	S-40S	Guard	3	0	Installation
	DR	125	S-40S	Guard	15	41	Installation
-	DR	150	S-40S	Guard	5	12	Installation
	VVPHTS	65	S-40S	Process	90	20	Installation
	VVPHTS	150	S-40S	Process	36	10	Installation
	VVPHTS	100	S-40S	Guard	50	20	Installation
	VVPHTS	125	S-40S	Guard	7	67	Installation
	VVPHTS	150	S-40S	Guard	12	9	Installation
	VVPHTS	200	S-20	Guard	23	17	Installation
	VVPHTS	250	S-40S	Guard	2	19	Installation
	DR	65	S-40S	Process	51	42	Fabrication+Installation
	DR	90	S-40S	Guard	3	6	Fabrication+Installation
	DR	100	S-40S	Guard	33	36	Fabrication+Installation
	DR	100	S-40S	Guard	12	18	Fabrication+Installation
	VVPHTS	65	S-40S	Process	408	222	Fabrication+Installation
	VVPHTS	125	S-40S	Process	3	9	Fabrication+Installation
	VVPHTS	150	S-40S	Process	51	9	Fabrication+Installation
	VVPHTS	90	S-40S	Guard	36	48	Fabrication+Installation
	VVPHTS	100	S-40S	Guard	282	219	Fabrication+Installation
	VVPHTS	125	S-40S	Guard	24	132	Fabrication+Installation
	VVPHTS	150	S-40S	Guard	42	39	Fabrication+Installation
	VVPHTS	200	S-20	Guard	45	45	Fabrication+Installation
	VVPHTS	250	S-40S	Guard	3	9	Fabrication+Installation
	IBED	65	S-40S	Process	276	150	Fabrication+Installation
	IBED	100	S-40S	Process	69	96	Fabrication+Installation
	IBED	90	S-40S	Guard	18	39	Fabrication+Installation
	IBED	100	S-40S	Guard	195	144	Fabrication+Installation
	IBED	125	S-40S	Guard	42	123	Fabrication+Installation
	IBED	150	S-80S	Guard	72	96	Fabrication+Installation

In Cryostat TCWS piping installation Overview of Scope of Work



CWP [NonFP but Captive] Install Upper IBED PHTS Pipework (18) – Installation from Jan. 2030 to Jun. 2031



In Cryostat TCWS piping installation Overview of Scope of Work

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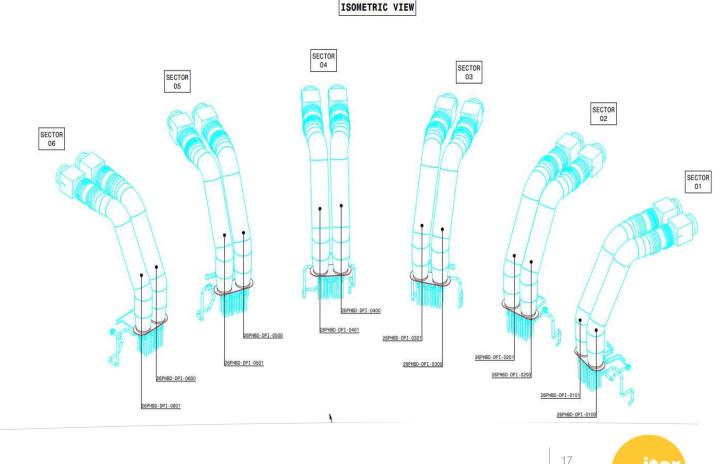
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CWP [NonFP but Captive] Install Upper IBED PHTS Pipework (18) – Installation from Jan. 2030 to Jun. 2031

The Isometric view is for pipework #1 to #6.

The Isometric view for pipework #7 to #12 has same configuration in the relative sectors.

The Isometric view for pipework #13 to #18 has same configuration in the relative sectors.



CWP [NonFP but Captive] Install Upper IBED PHTS Pipework (18) – Installation from Jan. 2030 to Jun. 2031

36 no. IBED Bundles includes below parts plus the connections to the Bioshield penetrations: Process pipe DN40, DN50, DN65. Guard pipe DN600. Guard elbow DN600, DN700.

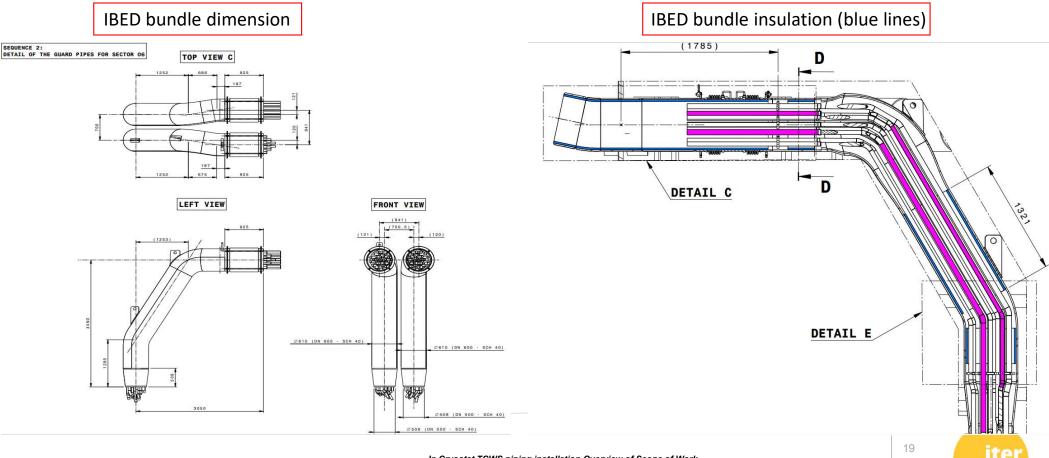
- Pipes 8000 meter including bending
- Fittings 360 no.
- Bundle Spacers 72 no. 2700Kg
- Bellows 36 no.
- Interface plates to chimney box 18 no. 3200Kg.
- Bronze bushing 800 no.
- Thermal insulation a lot for 36 no. IBED Bundles

Interface with chimney box installed by the other Contractor in B11 Cryostat @ L2. Interface with Cryostat upper cylinder installed by the other Contractor. Interface with Bioshield penetration installed by the other Contractor in B11 Cryostat space room @ L3.



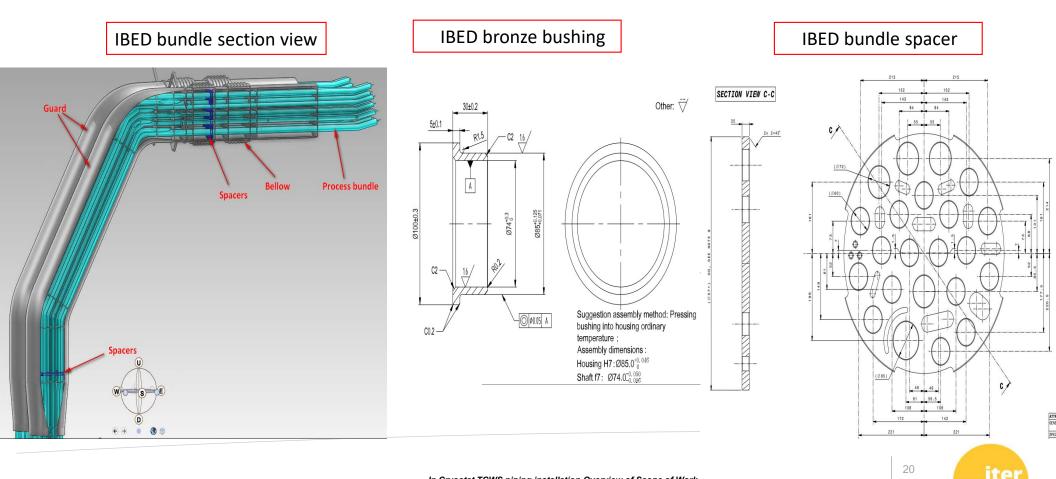


CWP [NonFP but Captive] Install Upper IBED PHTS Pipework (18) – Installation from Jan. 2030 to Jun. 2031

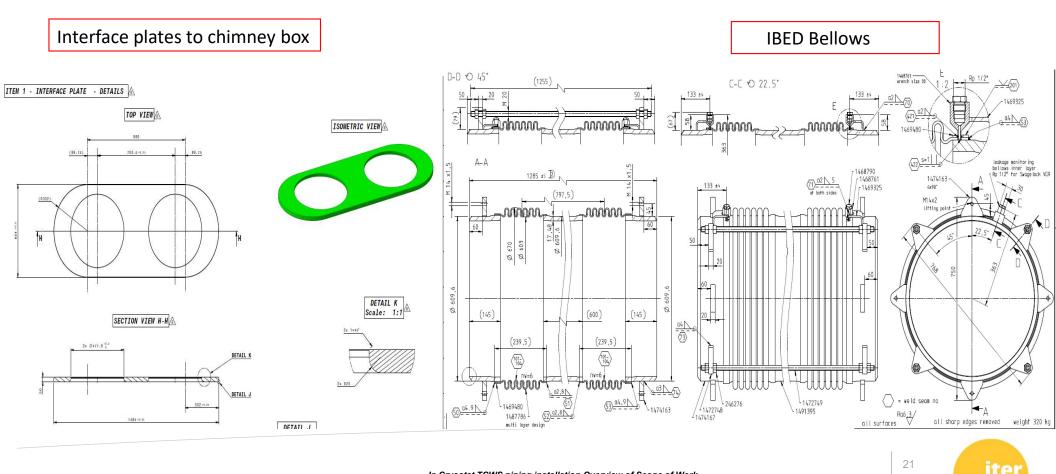


In Cryostat TCWS piping installation Overview of Scope of Work

CWP [NonFP but Captive] Install Upper IBED PHTS Pipework (18) – Installation from Jan. 2030 to Jun. 2031



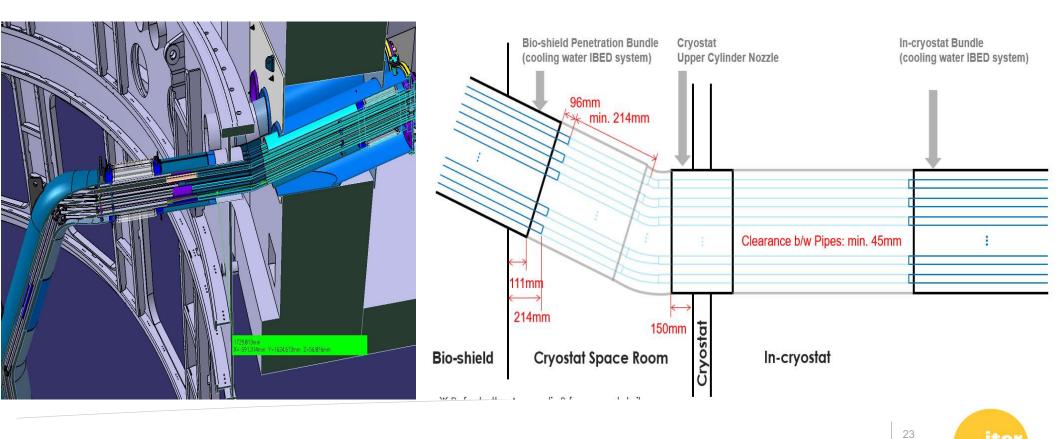
CWP [NonFP but Captive] Install Upper IBED PHTS Pipework (18) – Installation from Jan. 2030 to Jun. 2031



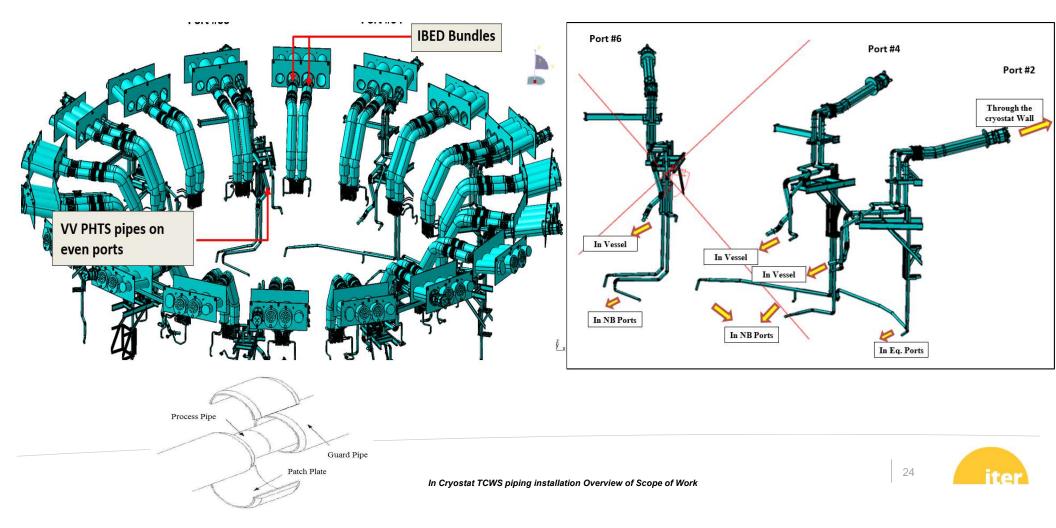
CWP [NonFP but Captive] Install Upper IBED PHTS Pipework (18) – Installation from Jan. 2030 to Jun. 2031 Connections in Cryostat space room

CWP [NonFP but Captive] Install Upper IBED PHTS Pipework (18) – Installation from Jan. 2030 to Jun. 2031

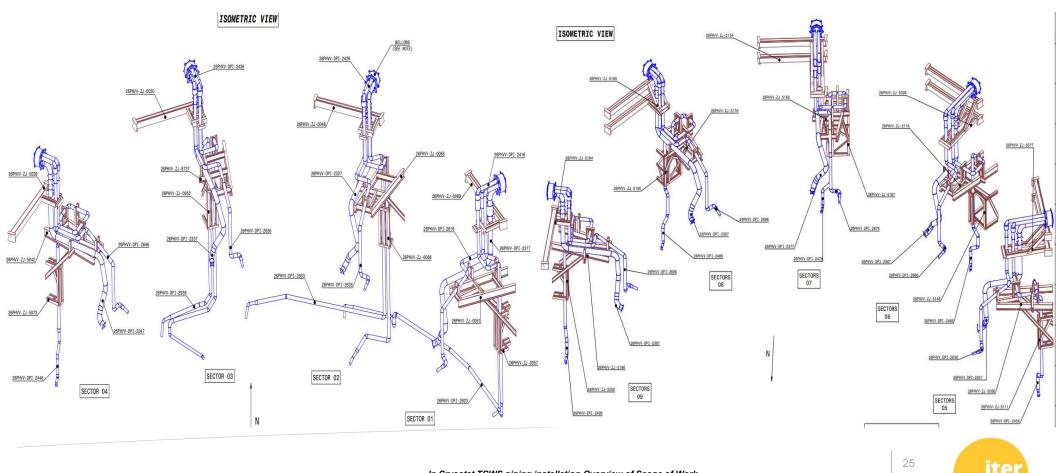
Connections in Cryostat space room



CWP - Install Upper VV PHTS Pipework (9) – Installation from Feb. 2030 to Jan. 2031



CWP - Install Upper VV PHTS Pipework (9) – Installation from Feb. 2030 to Jan. 2031



<u>CWP - Install Upper VV PHTS Pipework (9) – Installation from Feb. 2030 to Jan. 2031</u>

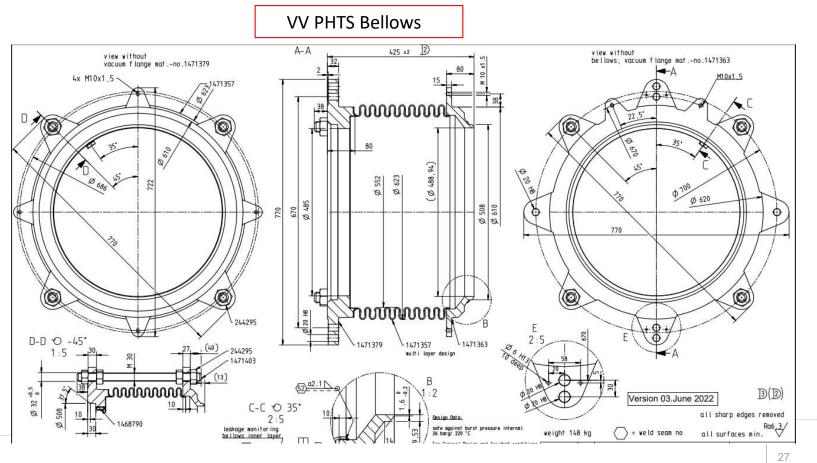
Interface with vacuum vessel installed by the other Contractor in B11 Cryostat @ L1 and L2.

Interface with Cryostat upper cylinder installed by the other Contractor.

Interface with Bioshield penetration installed by the other Contractor in B11 Cryostat space room @ L3.



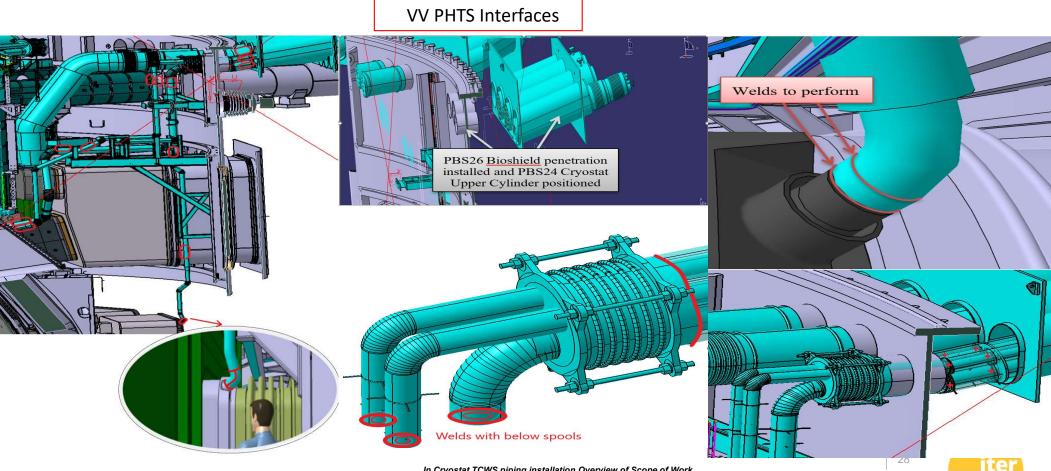
<u>CWP - Install Upper VV PHTS Pipework (9) – Installation from Feb. 2030 to Jan. 2031</u>



In Cryostat TCWS piping installation Overview of Scope of Work

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<u>CWP - Install Upper VV PHTS Pipework (9) – Installation from Feb. 2030 to Jan. 2031</u>



CWP - Install Upper VV PHTS Pipework (9) – Installation from Feb. 2030 to Jan. 2031

Supports include spacers – 25500 Kg.

Bellows - 9 no.

r		i		i		
System	Diameter (DN)	Thickness (Sch.)	Process/Guard	Length (m)	Fittings (no.)	Fabrication/Installation
VVPHTS	65	S-40S	Process	260	30	Fabrication+Installation
VVPHTS	125	S-40S	Process	10		Fabrication+Installation
VVPHTS	150	S-40S	Process	100	20	Fabrication+Installation
VVPHTS	90	S-40S	Guard	10	20	Fabrication+Installation
VVPHTS	125	S-40S	Guard	220	170	Fabrication+Installation
VVPHTS	150	S-40S	Guard	10		Fabrication+Installation
VVPHTS	200	S-20	Guard	90	40	Fabrication+Installation
••••••	200	0-20	Oudiu	50	40	



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7. Scope of procurement

IO is responsible for supply of all components, pipes, fittings and support structure material for the permanent works.

The scope of supply by the Contractor is typically limited to the supply of consumables includes welding filler metal material.

The Contractor shall provide all consumables required for the installation works as well as temporary work fabrications such as: material for testing and flushing, lifting assemblies, temporary access platform, temporary supports and restraints.

The Contractor shall transport all IO free issued material from IO warehouse to the Contractor's fabrication workshop. All material will be packed, delivered, stored and preserved according to vendors' requirements.

The Contractor shall provide local filtration and fume extraction units during welding operations.



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