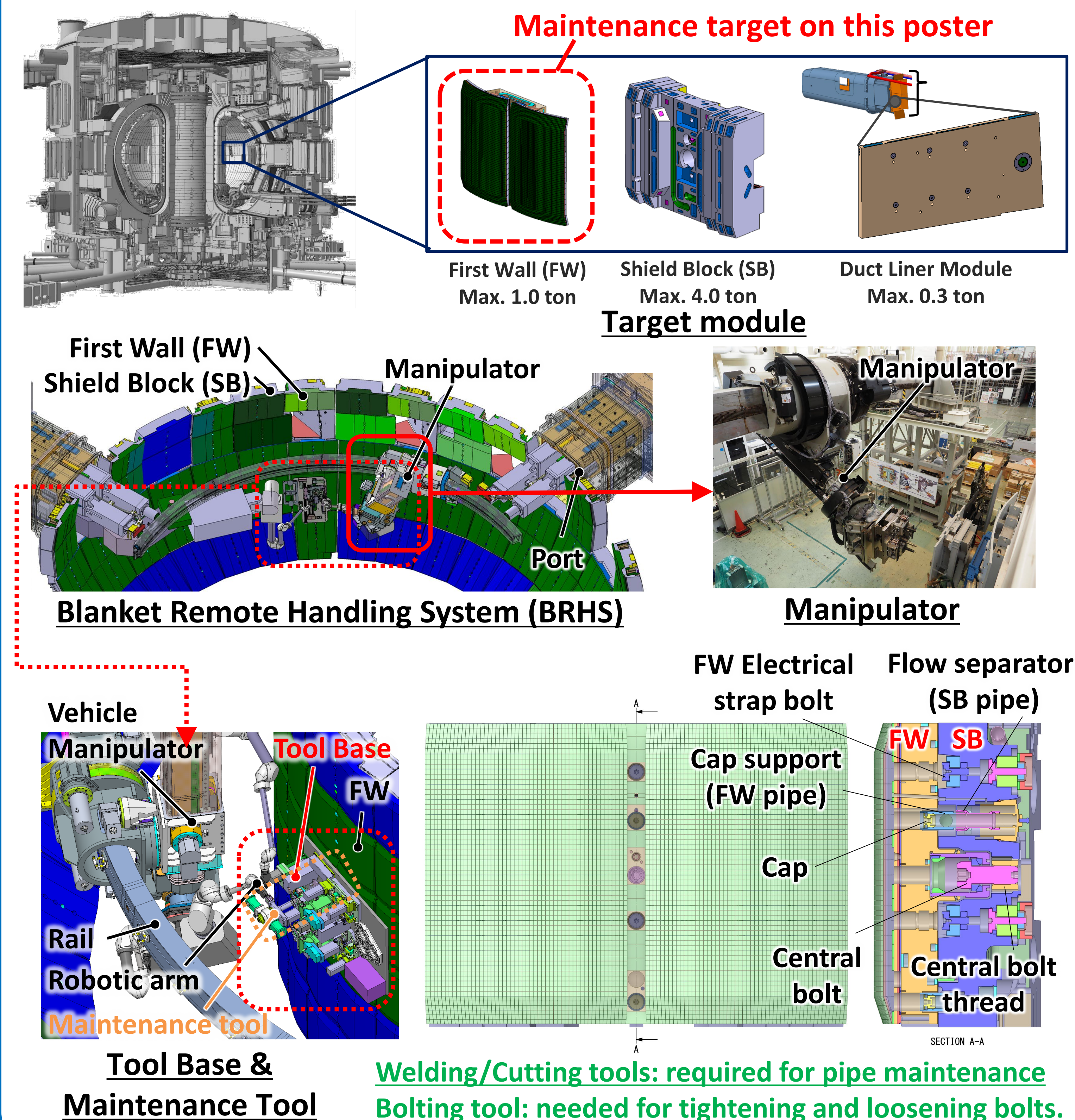


Conclusion

- Completed the preliminary design of the Tool Base, Cutting Tool, Welding Tool and Bolting Tool for the First Wall maintenance.
- Demonstrated the feasibility of the Gripping Finger element of the Tool Base through two types of the tests.
- Conducted the welding test using the pipe sample cut with the Cutting Tool, and revealed the need to alter the welding condition.
- Demonstrated that the Bolting Tool was capable of absorbing assumed misalignments and applying a high torque of 8.4 kNm.

Overview

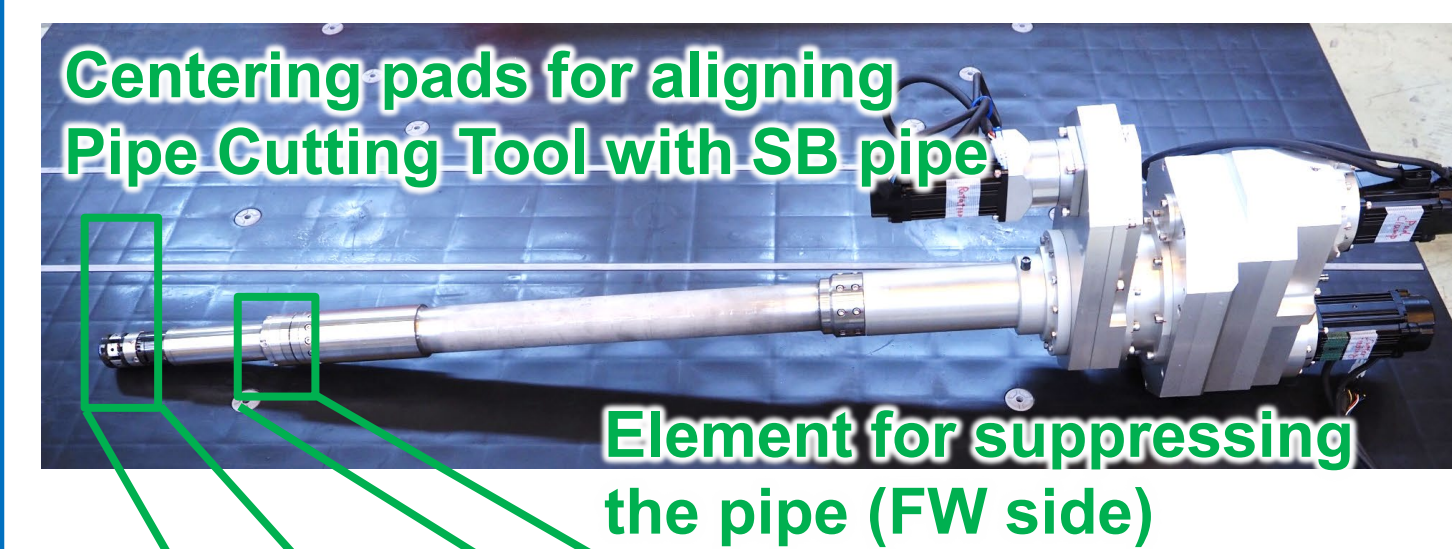
Overview of ITER Blanket RH System and First Wall Tools



Development results of Maintenance Tools

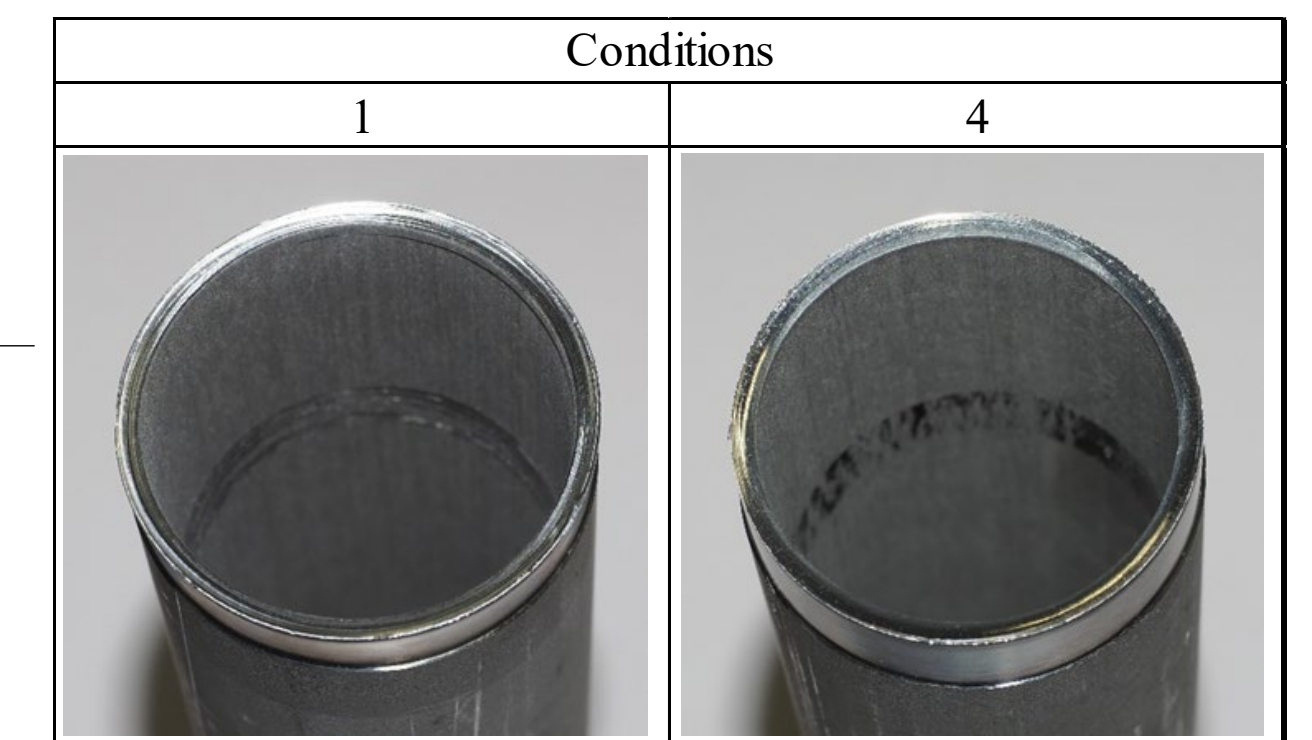
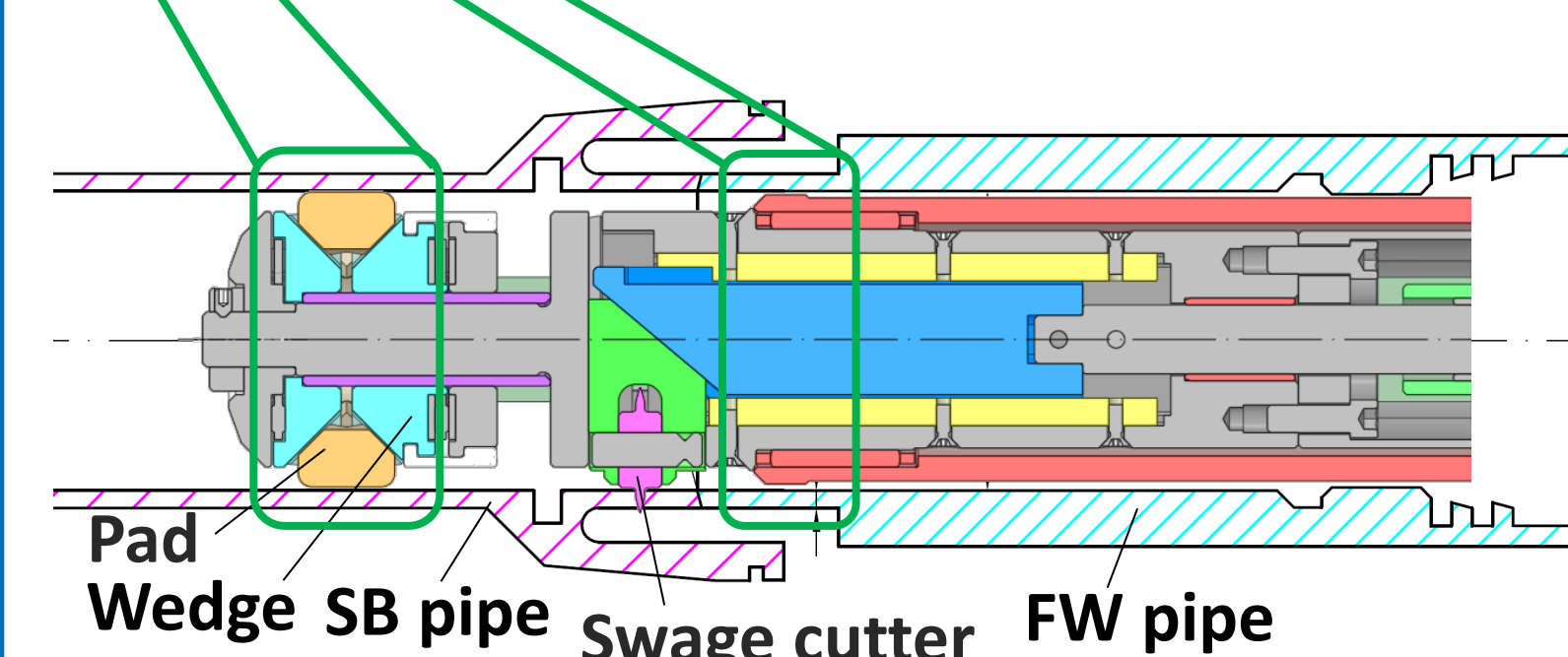
Cutting Tool

Define the cutting conditions for ≤ 0.3 mm the pipe deformation.



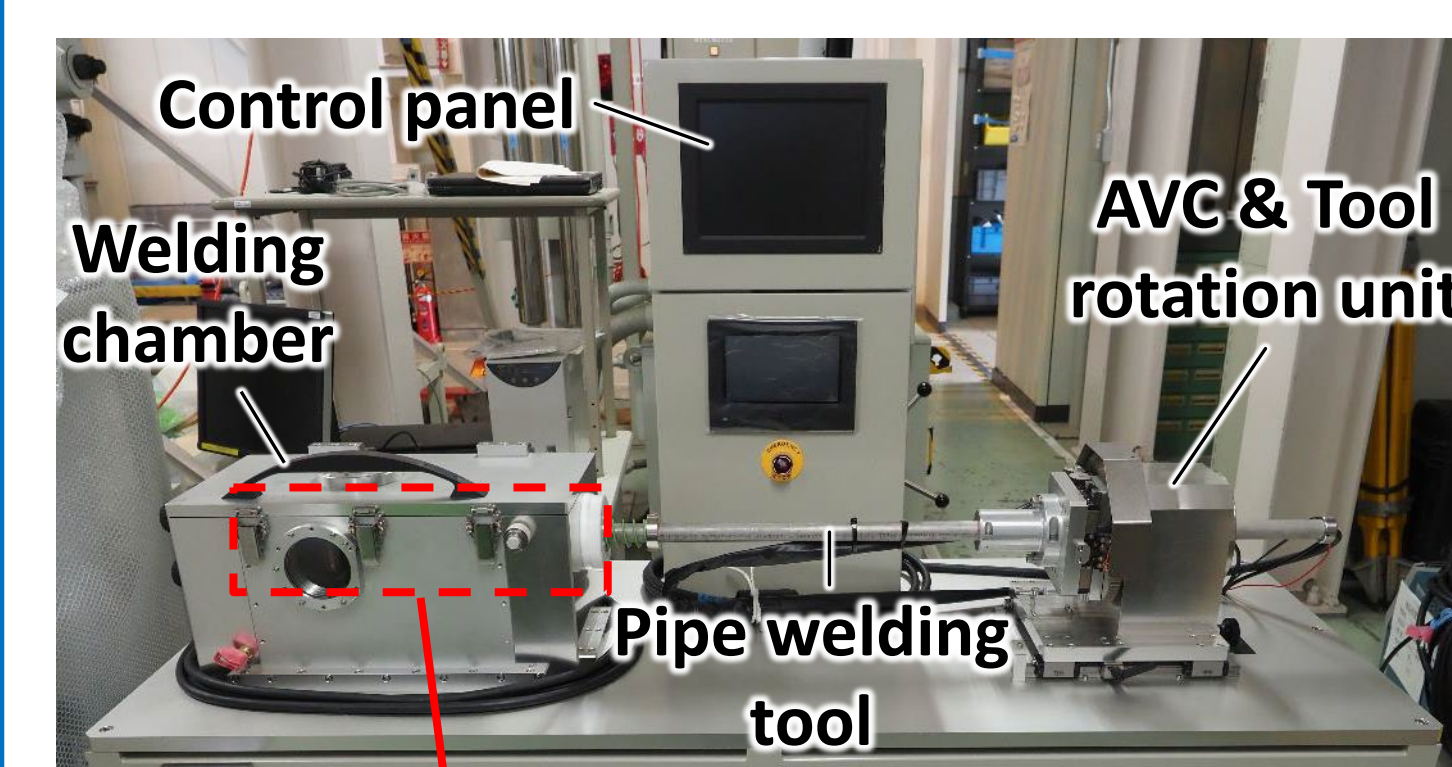
Cutting conditions and results

Cutting Conditions	1	2	3	4
Cutter Feed rate [mm/s]	0.004	0.01	0.02	0.04
Cutter Rotation speed [rpm]	5	5	5	5
Cutting Results				
Deformation amount [mm]	0.20~0.25	0.40~0.60	1.00~1.10	1.40~1.55



Welding Tool

Full circumferential weldability were verified using the pipe samples cut by the swage cutter.

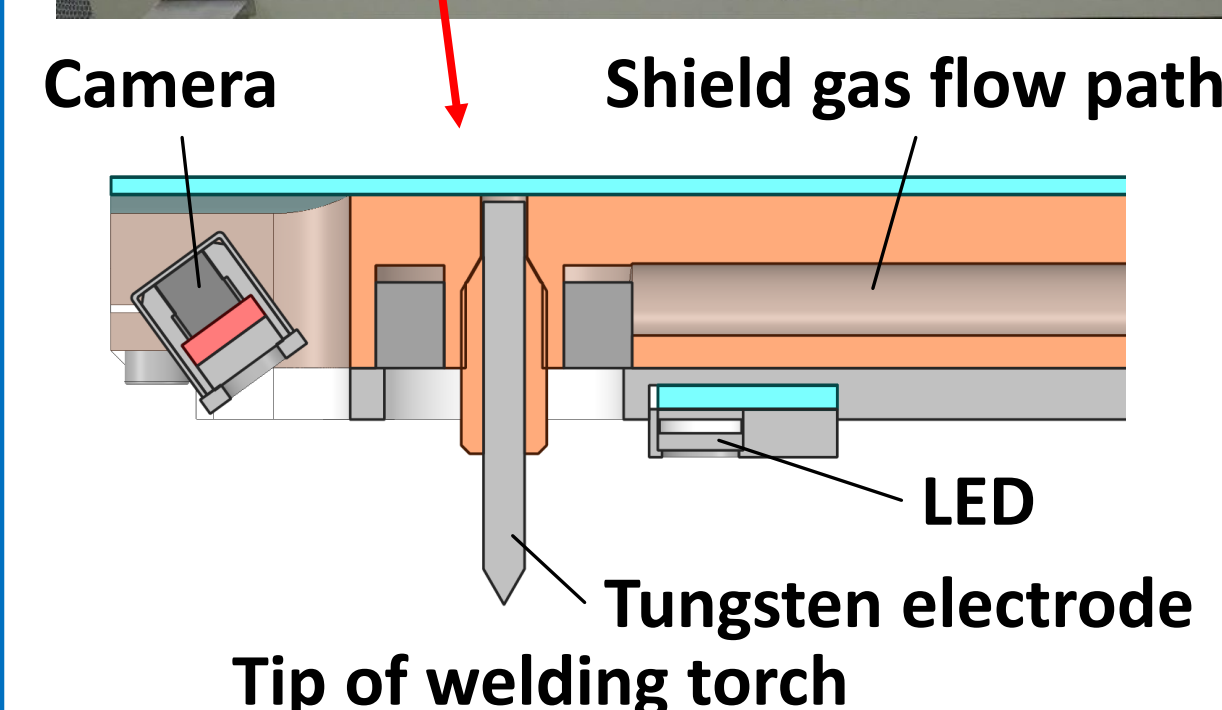


Welding conditions

Item	Specification
Welding posture	Horizontal
Operation current and voltage	See the Table 4
Shield gas	Ar 50% + He 50%
O ₂ concentration at inside of pipe sample	Less than 100 ppm
O ₂ concentration at outside of pipe sample	Less than 100 ppm
Misalignment of pipes groove	Less than 0.05 mm

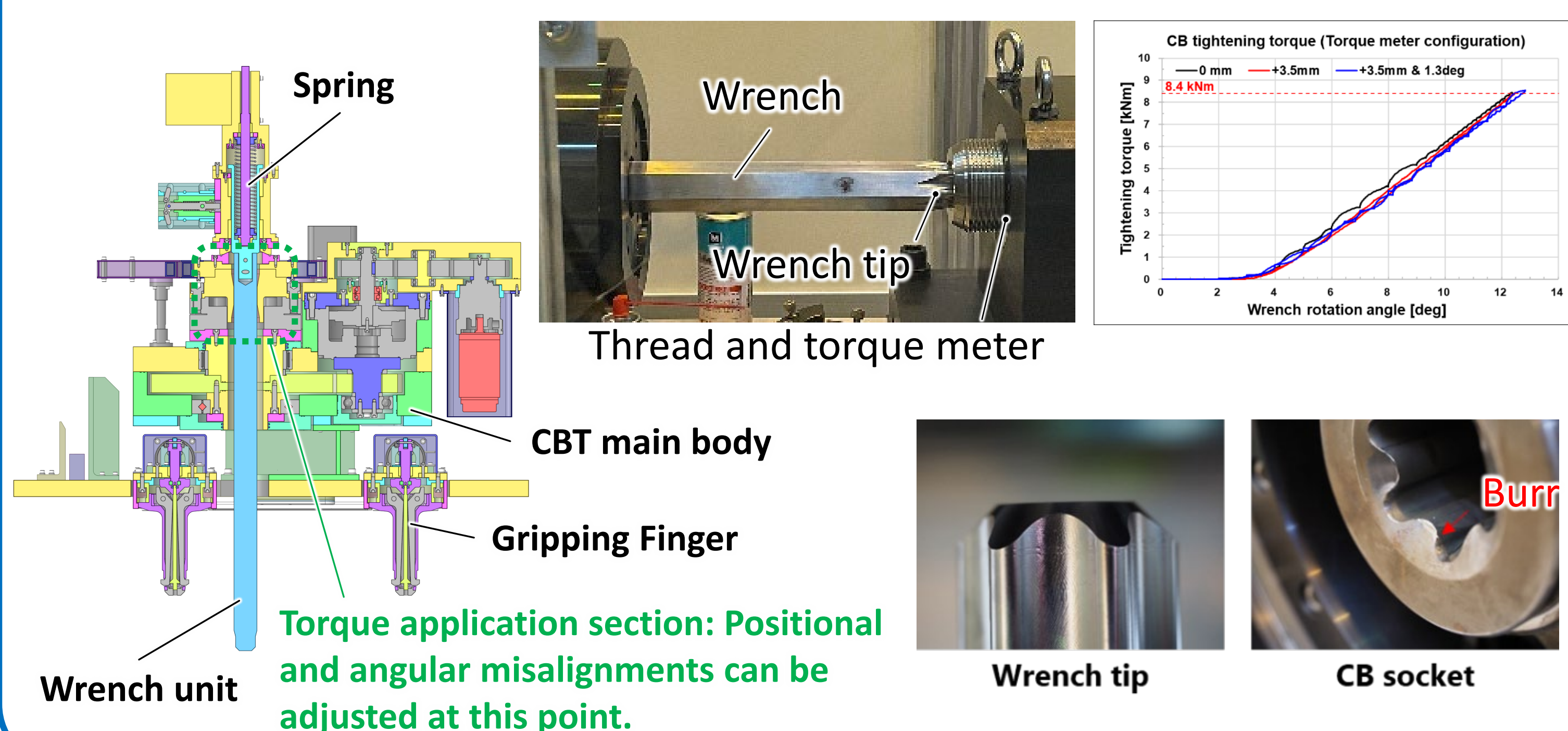
Welding results

		Cutter blade feeding speed [mm/s]			
		0.004	0.01	0.02	0.04
Position	180 deg (Near the welding start and end point)				
	270 deg				



Bolting Tool

Even with the expected misalignment (3.5 mm & 1.3 deg.), tool insertion into the thread is feasible, and a torque of 8.4 kNm can be applied.



Future plan

- Tool Base:** We will prototype the tool fixing element and evaluate its effectiveness.
- Cutting Tool:** We will proceed with design modifications to prevent rotation of the centering element during cutting, and conduct an evaluation of the cutter life.
- Welding Tool:** We will continue to investigate welding conditions that enable full penetration.