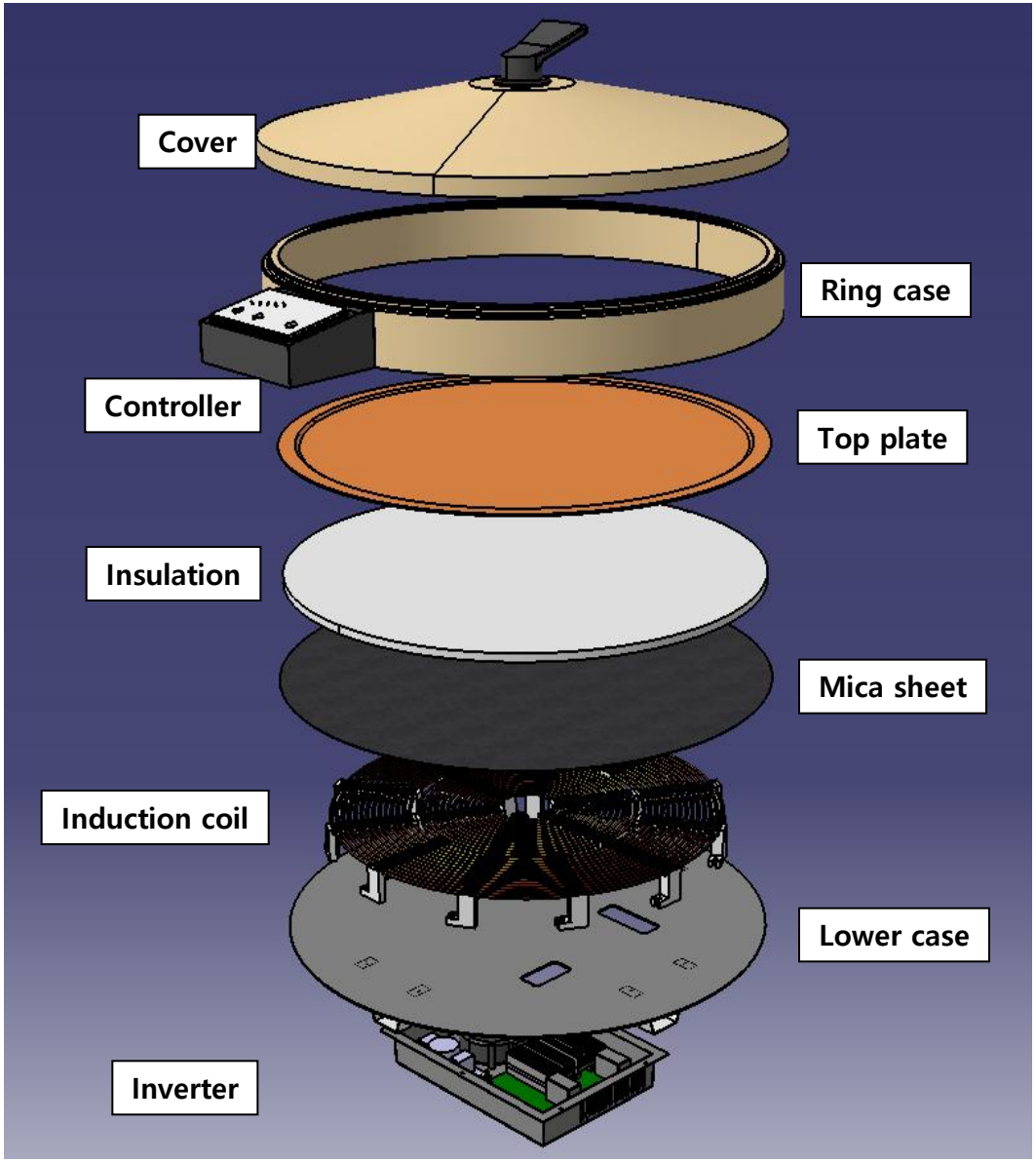
JARWON ELECTRONICS

ktl 한국산업기술시험원 Korea Testing Laboratory

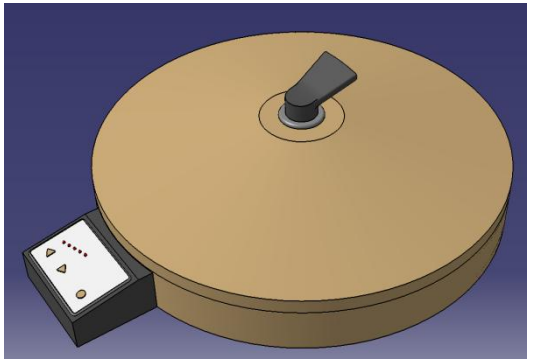
Development of IH Mitad Stove

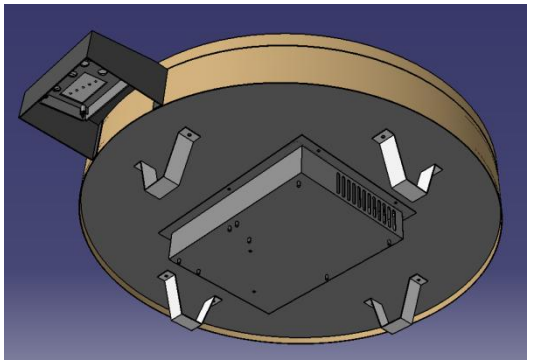
1st
Proto type

IH Mitad Stove(Proto Sample) Images



<Image 1>





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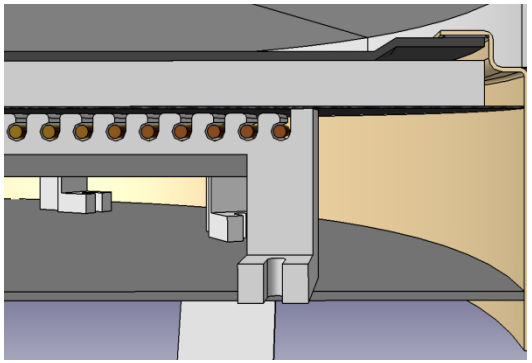


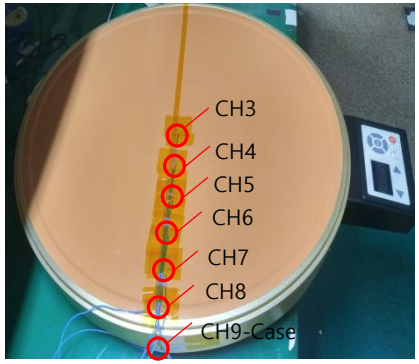
<Image 3>

IH Mitad Stove Specifications (1st Proto type)

Description	Specification	Remarks
1. Rating	220 [V], 50 / 60 [Hz]	
2. Input Power	2.0 [kW]	
3. Operating voltage	220 [V] ± 15 [%] : 187 ~ 253 [V]	
4. Cut off voltage	Low: 165 [V], High: 265 [V]	To protect IH inverter
5. Heating elements	Induction heating(**IH**) heater - Operating frequency: 21~35 [kHz] - Power level 1: 1.2 [kW] 2: 1.4 3: 1.6 4: 1.8 5: 2.0	Instead of power Level, temperature level control is possible (ex). - Temp. level 1: 230 [°C] 2: 240 3: 250 4: 260 5: 270
6. Controller	Micom , 3Keys & 5 Dot LEDs	
7. Fuse	250V/12A	On board (Soldering)
8. Power cord	1.5 ㎟, 3Wires (Live, Neutral, PE Ground)	
9. Cook zone material	Ceramic coating on 2 ply clad metal - Top side: Aluminum (t: 1.5mm) - Bottom: Stainless steel (430 t: 0.5mm)	Put the iron in the clay plate, the plate is broken in dry or baking process.
10. Body material	- Cover: Aluminum (t: 1.2) ➔ STS 304 (t: 0.7) - Ring case: Aluminum (t: 1.2) ➔ STS 304(t:0.7)	Aluminum has a good thermal conductivity, so with the hot surface, and there are many heat loss.

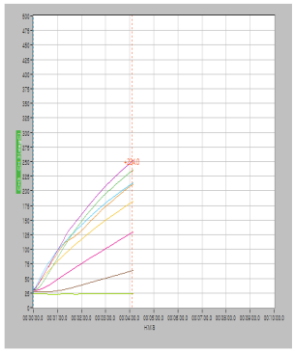
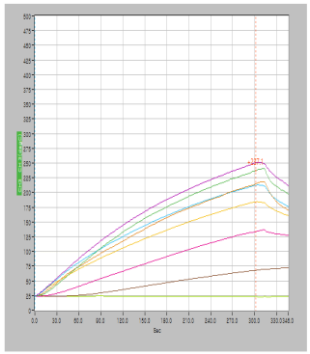
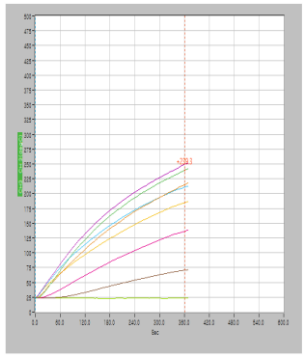
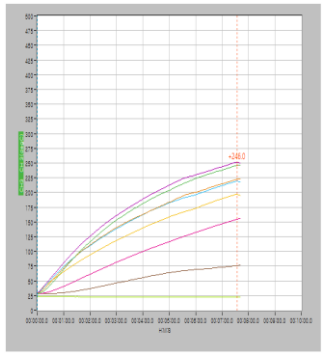
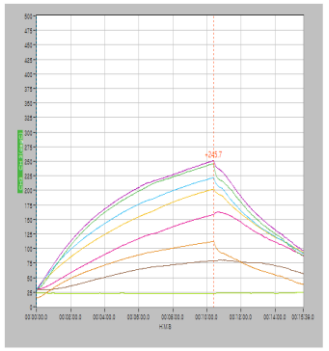
IH Mitad Stove Temp. Rising Test

1. Test position

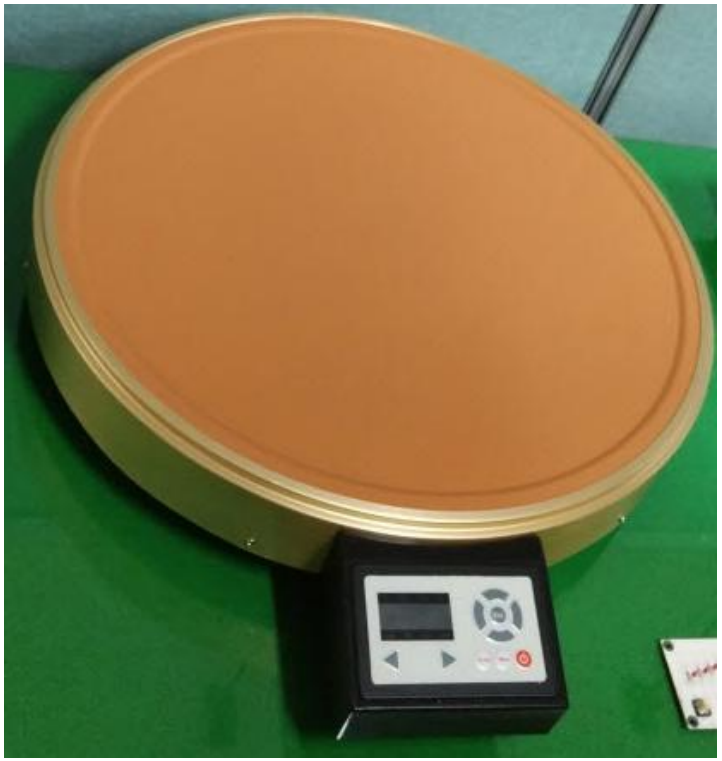


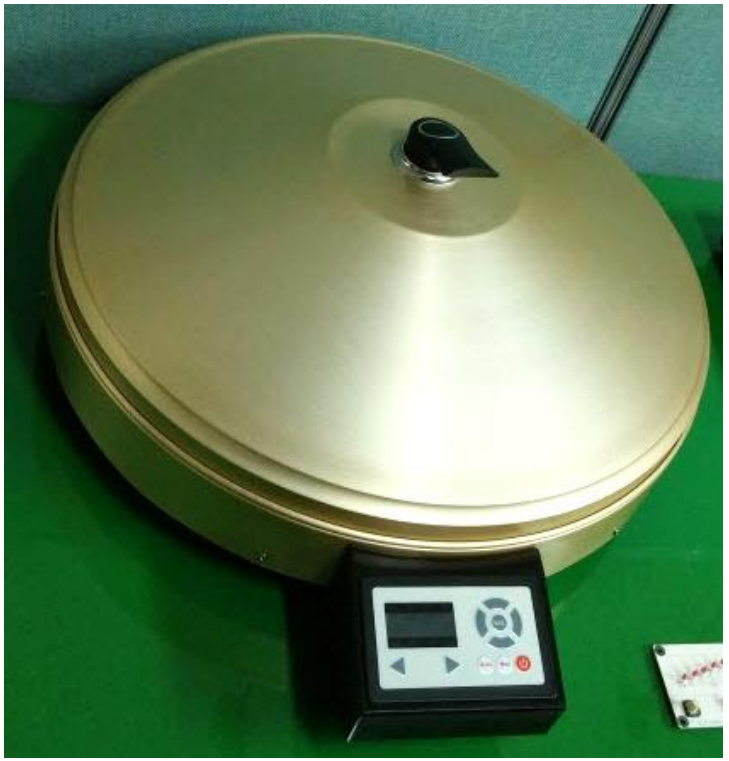
Channel	Position
CH3	Center
CH4	54mm from center
CH5	108
CH6	162
CH7	216
CH8	270
CH9	Ring case

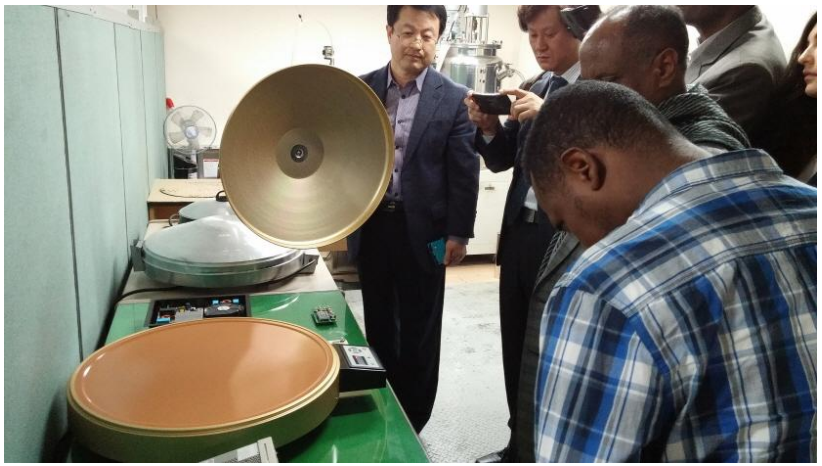
2. Test results

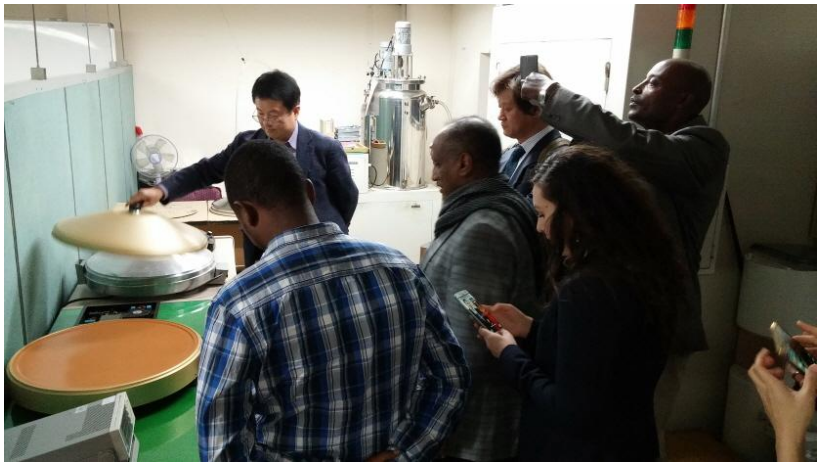
Power		2,000W(Hi)	1,800W(M. Hi	1,600W(Mid)	1,400W(M. Low)	1,200W(Low)
Temp. Rising						
Rising time	200℃	2′ 50″	3′ 21″	3′ 55″	4′ 26″	5′ 40″
	250℃	4′ 09″	5′ 00″	6′ 02″	7′ 25″	10′ 15″
Temp.	Max(CH4)	250℃	250℃	250℃	250℃	250℃
	Min(CH7)	180℃	184℃	184℃	196℃	202℃
	Diff.	70℃	66℃	66℃	54℃	48℃
Ring case temp.		62℃	68℃	70℃	75℃	79℃

IH Mitad Stove(Proto Sample) Pictures









2nd Engineering Sample (E/S)

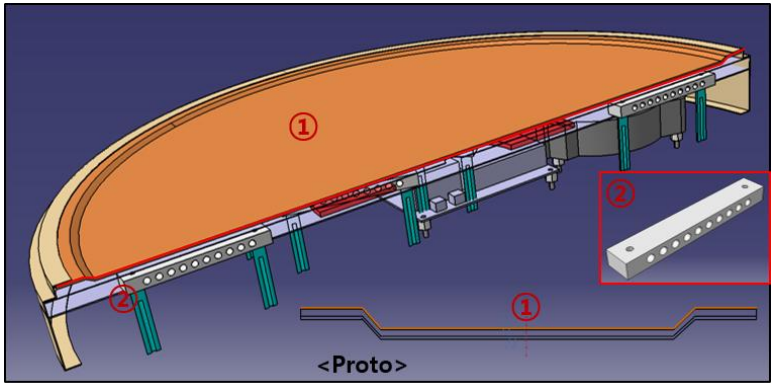
IH Mitad Stove(E/S) Manufacturing

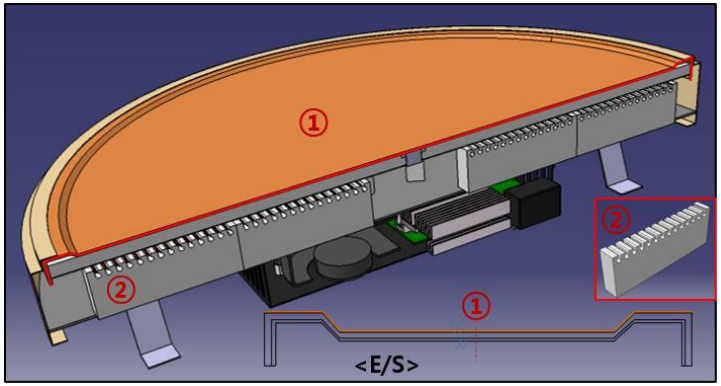
1. Schedule

- 1 sample of E/S, Assembly finished: 03/01/2017
- Measure temperature on baking plate(Temp. distribution): 17/01/2017
- Optimize coil distribution : 17/01/2017
- Development of control algorithm and adapt Firmware : 25/01/2017

Final E/S : 25/01/2017

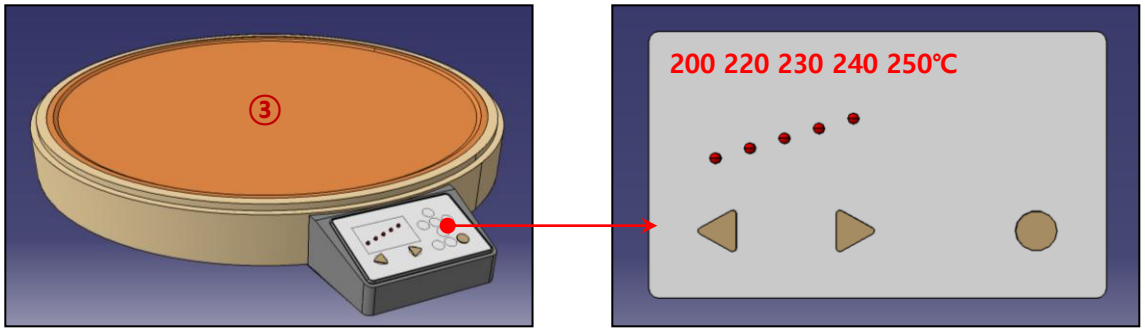
2. Proto → E/S, Improvement





① Change shape of Clad(Baking plate) (Prevent bending, Finished)

② Modify coil bracket (Increasing fixing hole, 10 → 14, Remove Bracket, Supporter)

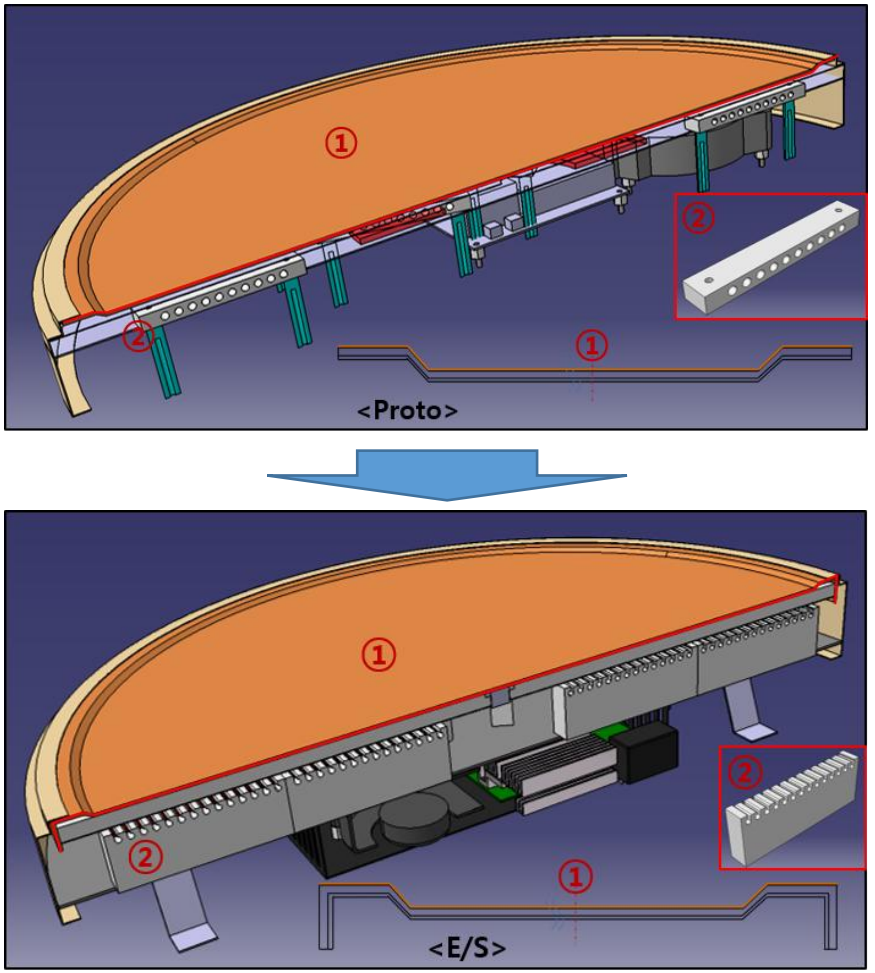


③ Adapt temperature sensor for On/Off control → Maintain temperature of baking plate in certain range of temperature (200, 220, 230, 240, 250℃) Need to verify way to fix temp. sensor to bottom of baking plate

Proto → E/S Improvements

① Change Outer Shape of Clad Top Plate (Prevent bending of Plate)

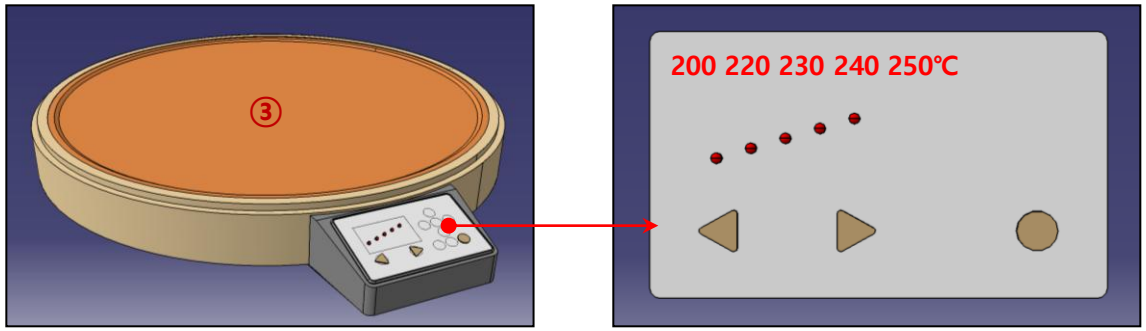
② Modification of the Coil Bracket (Increase the Number of Mounting Holes : 10 → 14, Bracket Support Removed)



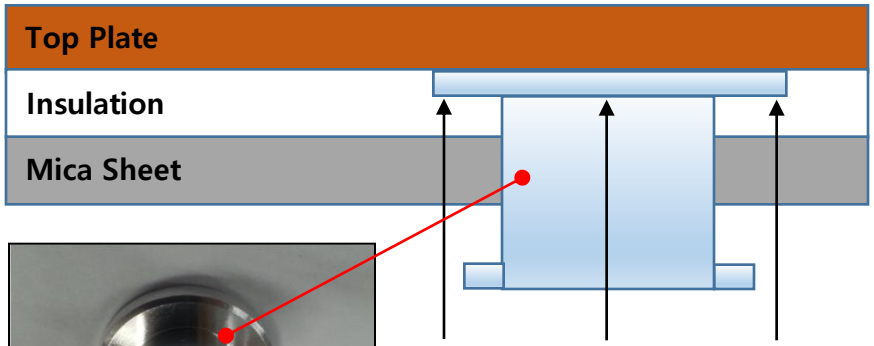
Proto → E/S Improvements

③ Apply temperature sensor for On/Off control →

Maintain temperature of top plate in certain range of temperature (200, 220, 230, 240, 250 ℃)



- Temperature Sensor needs to be fixed to Top Plate.



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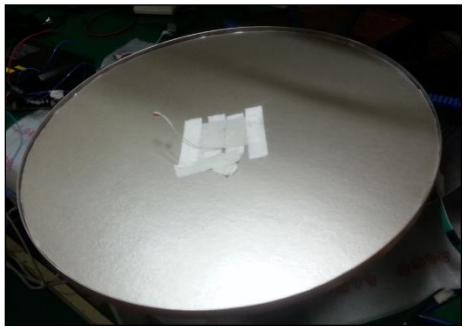
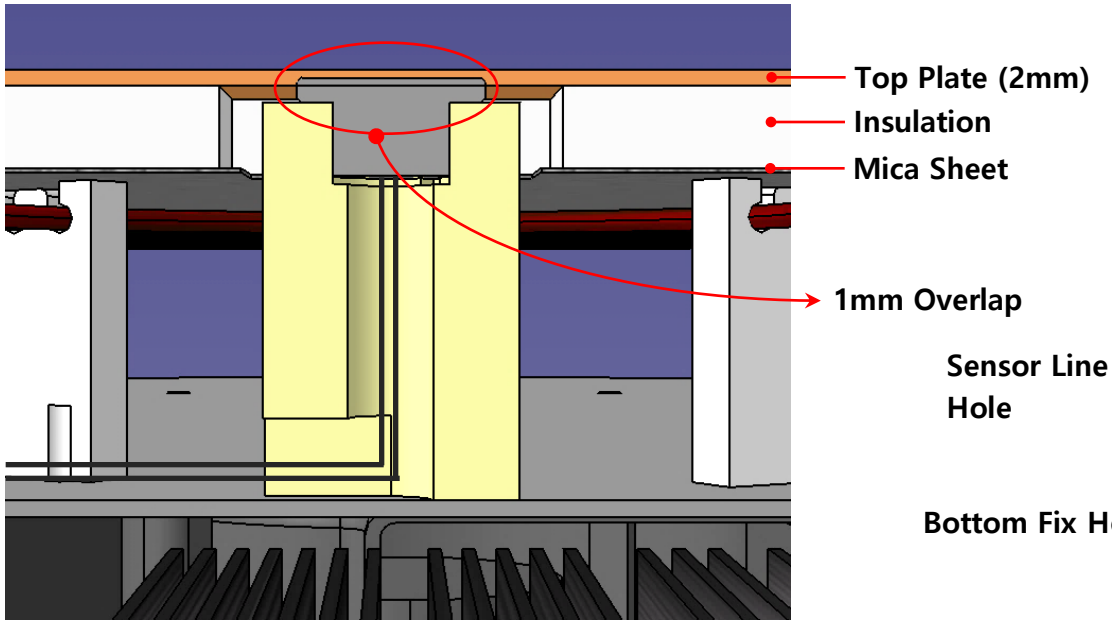


<Before Improvement : Asbestos Tape Finish After Insertion>

Proto → E/S Improvements

④ Fixing Temperature Sensor

- Top Sensor Stand



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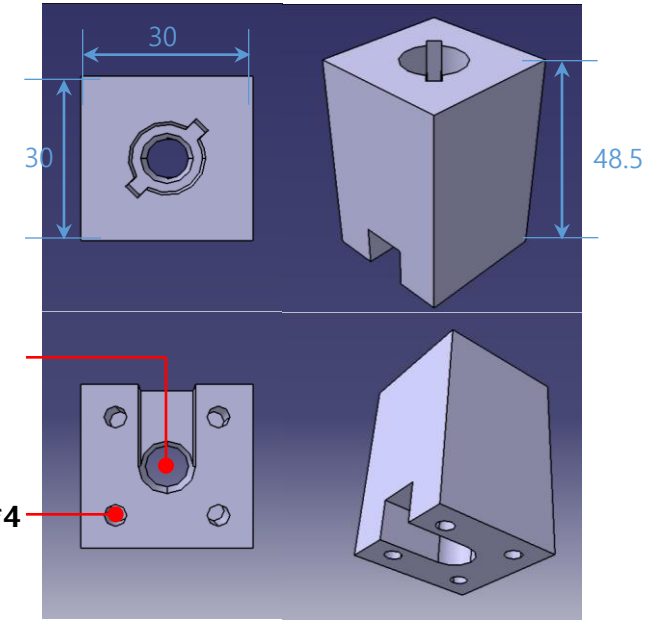
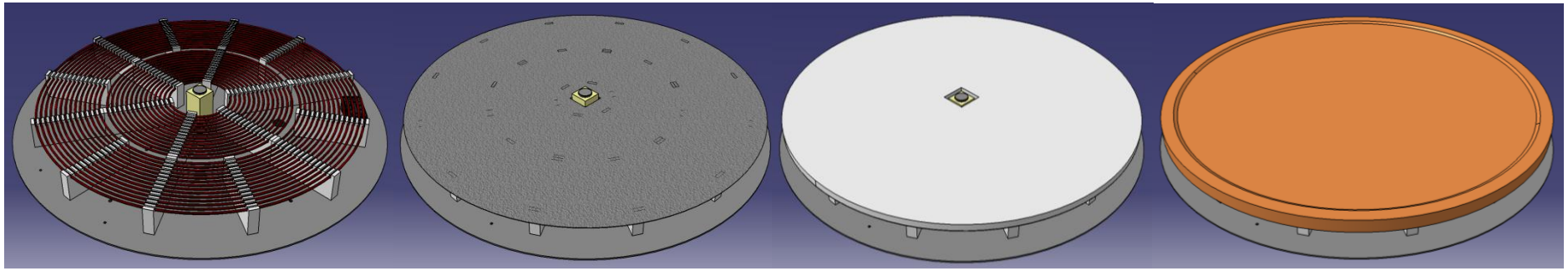
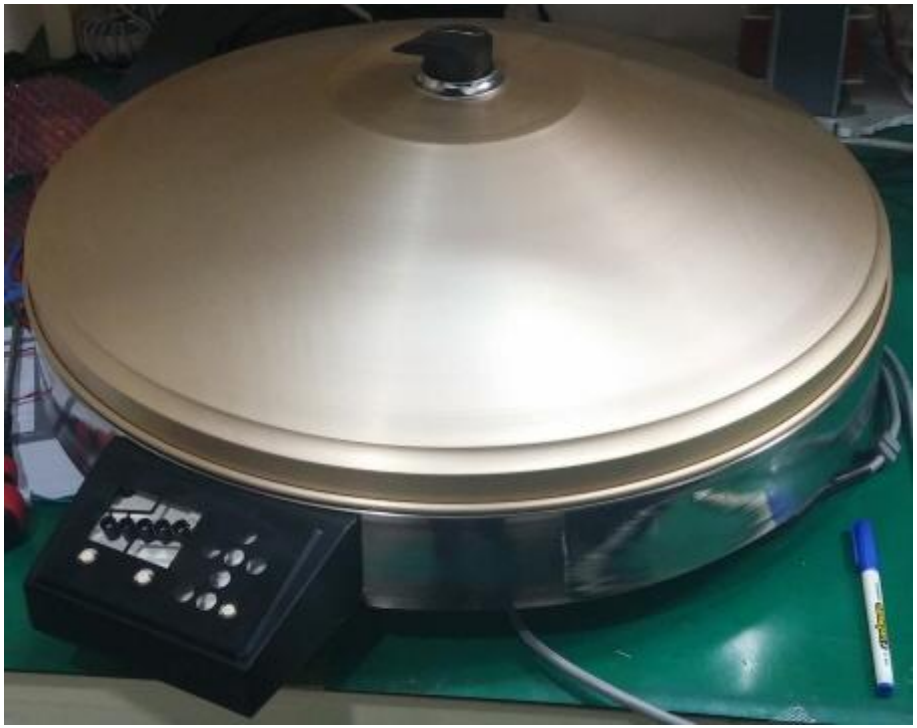
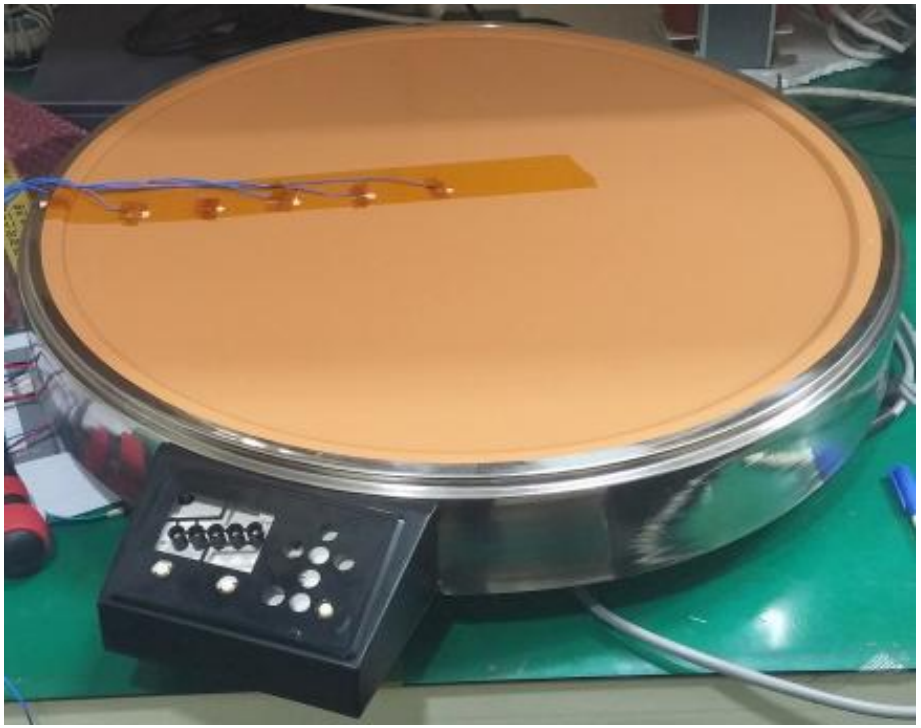


<Sensor Stand Appearance>

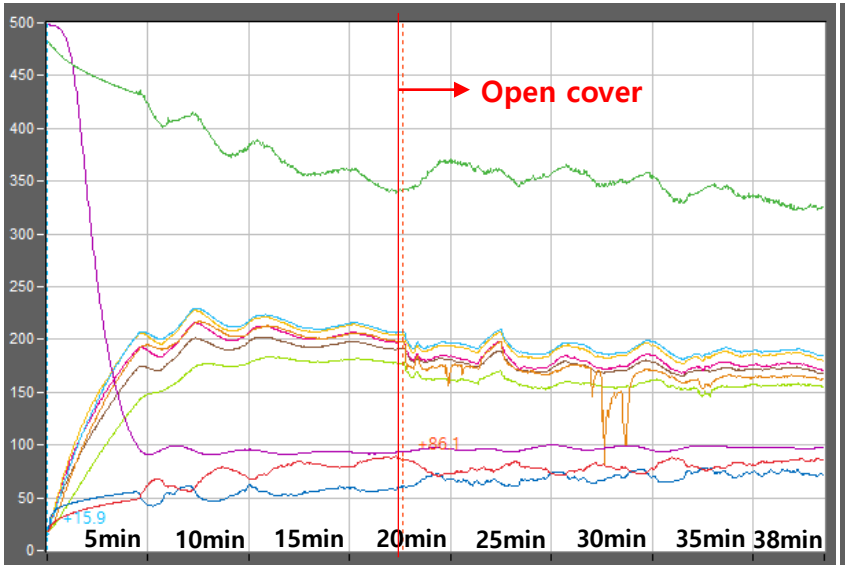


IH Mitad Stove(E/S) Pictures

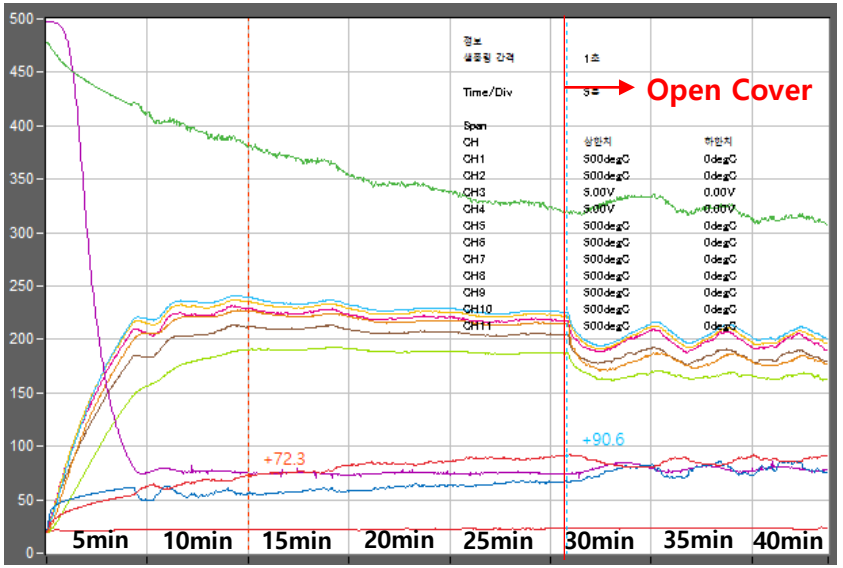




IH Mitad Stove(E/S) Temperature Test_1800W

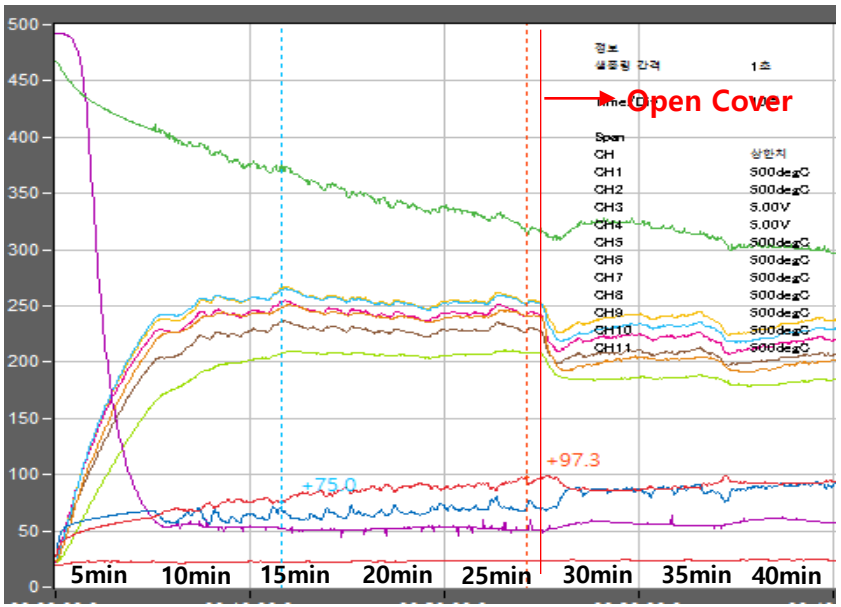


<200℃>

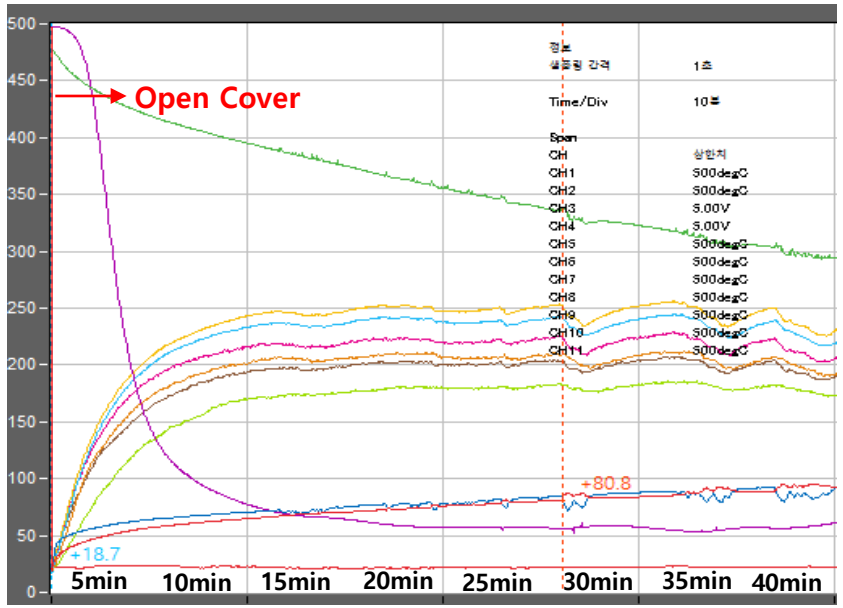


<210℃>

CH(ALL)	단위	항목
CH1 CH 1	degC	IGBT
CH2 CH 2	degC	Bridge Diode
CH3 CH 3	V	Heat Sink
CH4 CH 4	V	Top Sensor
CH5 CH 5	degC	Center
CH6 CH 6	degC	Center To 54mm
CH7 CH 7	degC	Center To 108mm
CH8 CH 8	degC	Center To 162mm
CH9 CH 9	degC	Center To 216mm
CH10 CH1	degC	Outside

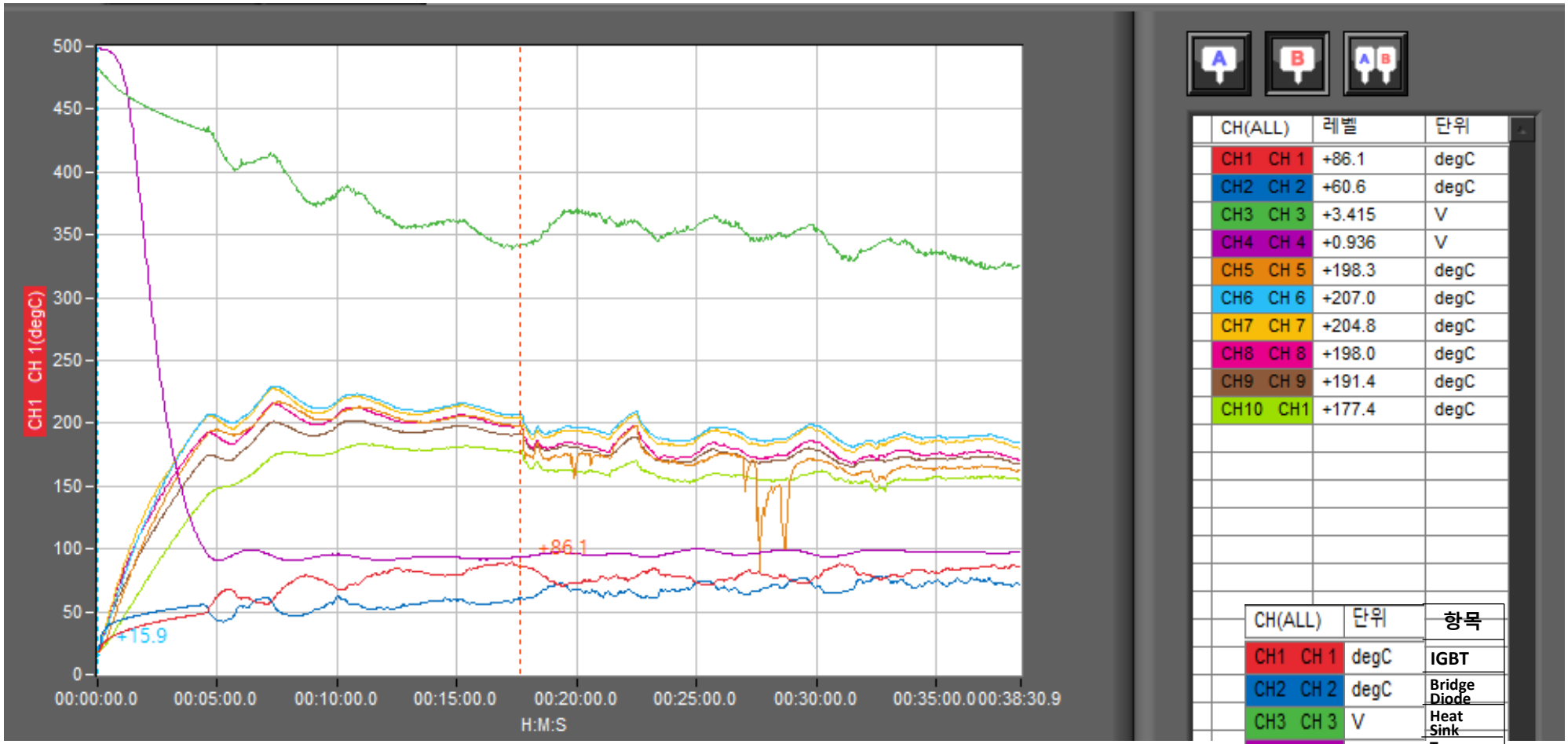


<230℃>



<Cover open_230℃>

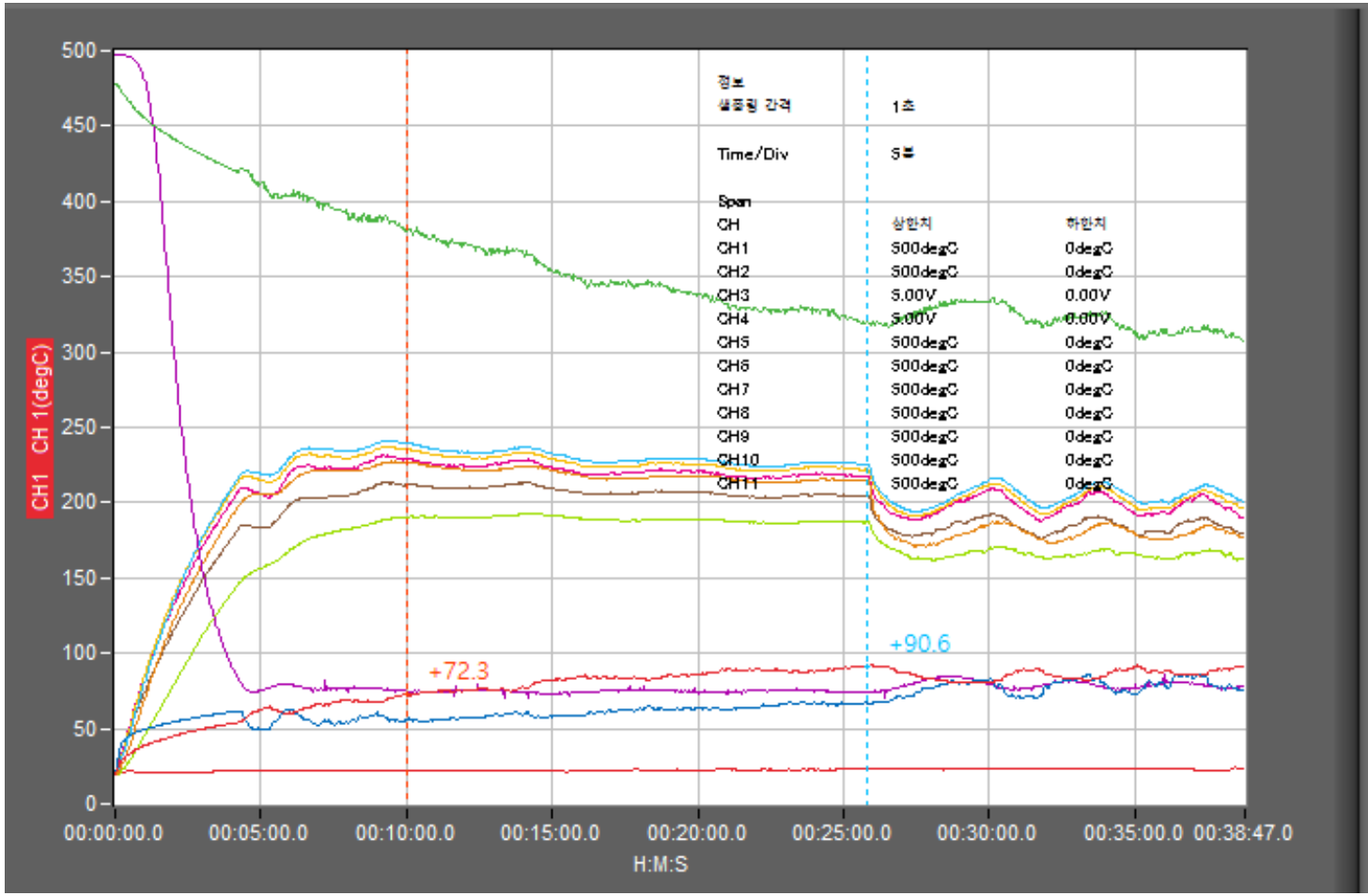
IH Mitad Stove(E/S) Temperature Test_1800W_200℃



CH(ALL)	레벨	단위
CH1 CH 1	+86.1	degC
CH2 CH 2	+60.6	degC
CH3 CH 3	+3.415	V
CH4 CH 4	+0.936	V
CH5 CH 5	+198.3	degC
CH6 CH 6	+207.0	degC
CH7 CH 7	+204.8	degC
CH8 CH 8	+198.0	degC
CH9 CH 9	+191.4	degC
CH10 CH1	+177.4	degC

CH(ALL)	단위	항목
CH1 CH 1	degC	IGBT
CH2 CH 2	degC	Bridge Diode
CH3 CH 3	V	Heat Sink
CH4 CH 4	V	Top Sensor
CH5 CH 5	degC	Center
CH6 CH 6	degC	Center To 54mm
CH7 CH 7	degC	Center To 108mm
CH8 CH 8	degC	Center To 162mm
CH9 CH 9	degC	Center To 216mm
CH10 CH1	degC	Outside

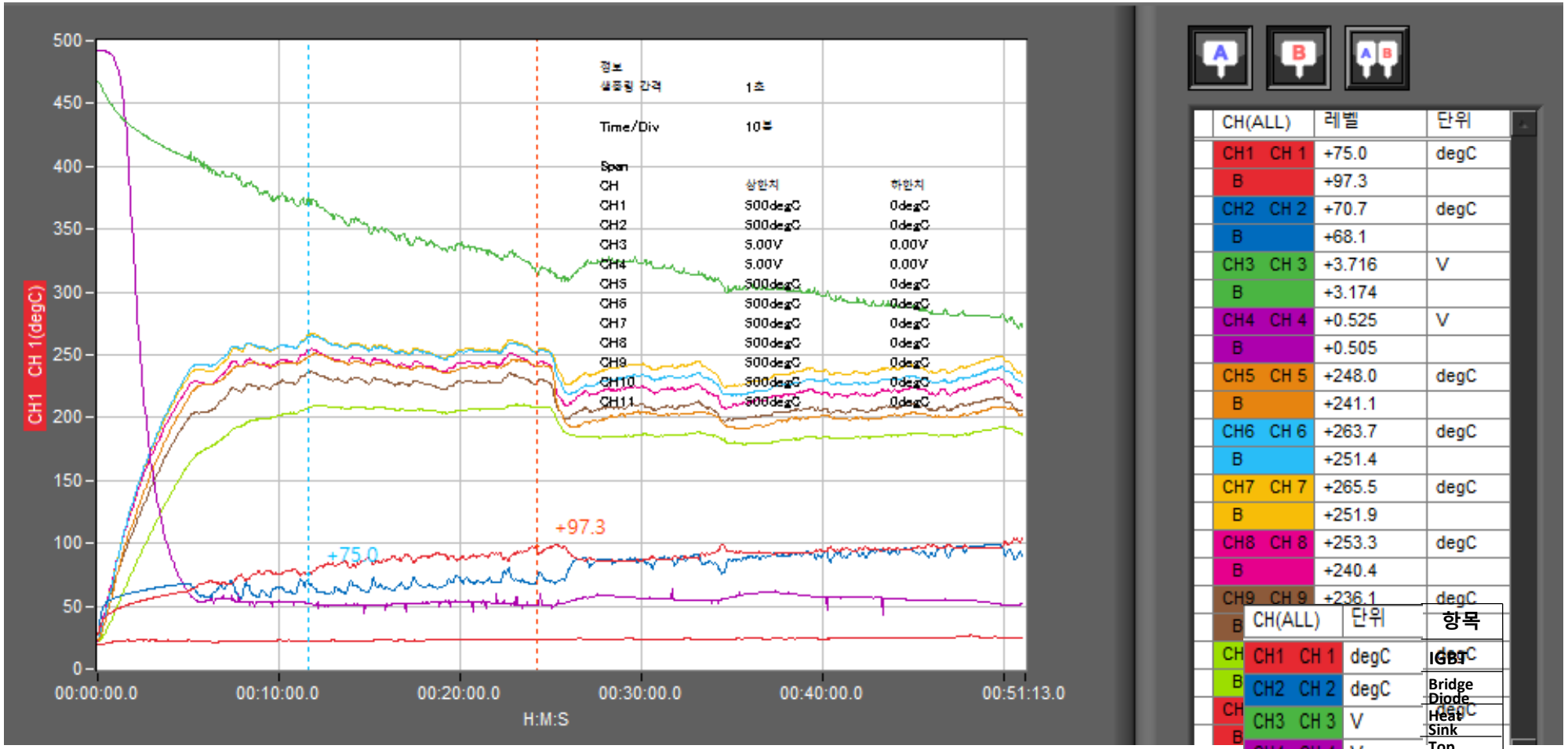
IH Mitad Stove(E/S) Temperature Test_1800W_210℃



CH(ALL)	레벨	단위
CH1 CH 1	+90.6	degC
B	+72.3	
CH2 CH 2	+67.5	degC
B	+55.7	
CH3 CH 3	+3.200	V
B	+3.815	
CH4 CH 4	+0.744	V
B	+0.749	
CH5 CH 5	+214.6	degC
B	+226.5	
CH6 CH 6	+225.4	degC
B	+239.3	
CH7 CH 7	+222.2	degC
B	+235.3	
CH8 CH 8	+217.5	degC
B	+228.8	
CH9 CH 9	+204.2	degC
B		
CH		degC
B		
CH		
B		

CH(ALL)	단위	항목
CH1 CH 1	degC	IGBT
CH2 CH 2	degC	Bridge Diode
CH3 CH 3	V	Heat Sink
CH4 CH 4	V	Top Sensor
CH5 CH 5	degC	Center
CH6 CH 6	degC	Center To 54mm
CH7 CH 7	degC	Center To 108mm
CH8 CH 8	degC	Center To 162mm
CH9 CH 9	degC	Center To 216mm
CH10 CH1	degC	Outside

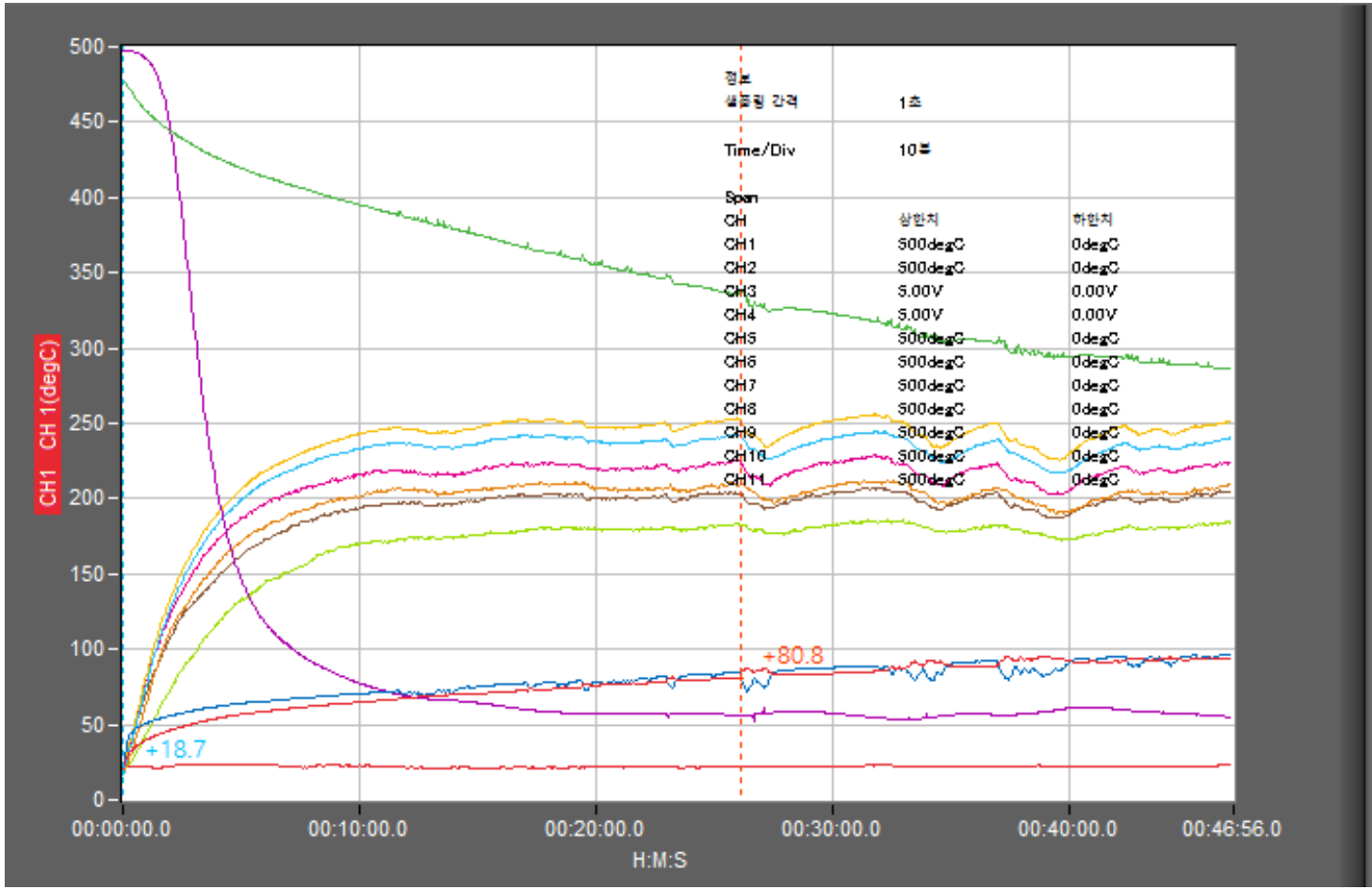
IH Mitad Stove(E/S) Temperature Test_1800W_230℃



CH(ALL)	레벨	단위
CH1 CH 1	+75.0	degC
B	+97.3	
CH2 CH 2	+70.7	degC
B	+68.1	
CH3 CH 3	+3.716	V
B	+3.174	
CH4 CH 4	+0.525	V
B	+0.505	
CH5 CH 5	+248.0	degC
B	+241.1	
CH6 CH 6	+263.7	degC
B	+251.4	
CH7 CH 7	+265.5	degC
B	+251.9	
CH8 CH 8	+253.3	degC
B	+240.4	
CH9 CH 9	+236.1	degC

CH(ALL)	단위	항목
CH1 CH 1	degC	IGBT
CH2 CH 2	degC	Bridge Diode
CH3 CH 3	V	Heat Sink
CH4 CH 4	V	Top Sensor
CH5 CH 5	degC	Center
CH6 CH 6	degC	Center To 54mm
CH7 CH 7	degC	Center To 108mm
CH8 CH 8	degC	Center To 162mm
CH9 CH 9	degC	Center To 216mm
CH10 CH1	degC	Outside

IH Mitad Stove(E/S) Temperature Test_1800W_230℃_Cover open



CH(ALL)	레벨	단위
CH1 CH 1	+80.8	degC
CH2 CH 2	+84.7	degC
CH3 CH 3	+3.381	V
CH4 CH 4	+0.561	V
CH5 CH 5	+208.7	degC
CH6 CH 6	+242.3	degC
CH7 CH 7	+253.1	degC
CH8 CH 8	+225.8	degC
CH9 CH 9	+203.4	degC
CH10 CH1	+182.9	degC
CH11 CH1	+22.2	degC

CH(ALL)	단위	항목
CH1 CH 1	degC	IGBT
CH2 CH 2	degC	Bridge Diode
CH3 CH 3	V	Heat Sink
CH4 CH 4	V	Top Sensor
CH5 CH 5	degC	Center
CH6 CH 6	degC	Center To 54mm
CH7 CH 7	degC	Center To 108mm
CH8 CH 8	degC	Center To 162mm
CH9 CH 9	degC	Center To 216mm
CH10 CH1	degC	Outside

Preparation for Injera Baking Test

Preparation for Injera Baking Test

<Teff Flour>

<Injera Batter Preparation>