

ID	Importance	Source	Function	Description	Unit of Measure	Marginal Value	Comments/Status	Test Plan	Concluded Condition
S1	9	PRP	System	Temperature of output bathing water	°C			S1, S2, S3 Test Plan	O
S2	3	PRP	System	Temperature of surrounding environment	°C			S1, S2, S3 Test Plan	O
S3	3	PRP	System	Total cost of materials	\$			S1, S2, S3 Test Plan	O
S4	9	PRP	System	Average burn time	Hours		Depends on amount of burn material	S4, S5, S7, S8, S9 Test Plan	O
S5	1	PRP	System	Hours of Training Required	Hours			S5, S10, S11, S15, S16, S17 Test Plan	O
S7	9	PRP	System	Time to heat the recovery system to ideal water temperature	Minutes			S4, S7, S8, S9 Test Plan	O
S8	9	PRP	System	Heat recovered from working fluid/hour	KJ			S4, S7, S8, S9 Test Plan	O
S9	9	PRP	System	Volume of water heated by the system	Liters			S4, S7, S8, S9 Test Plan	O
S10	3	PRP	System	Setup time to add recovery system	Minutes			S5, S10, S11, S15, S16, S17 Test Plan	O
S11	1	PRP	System	Operation Steps	#			S5, S10, S11, S15, S16, S17 Test Plan	O
S12	3	PRP	System	Product Lifetime	Years			S12 Test Plan	Δ
S13	1	PRP	System	Maximum mass of individual system component	kg			S13, 14 Test Plan	O
S14	3	PRP	System	Number of materials needed to construct system	#			S13, 14 Test Plan	X
S15	1	PRP	System	People needed to install system	#			S10, S11, S15, S16, S17 Test Plan	O
S16	1	PRP	System	Loading clearance	m²			S10, S11, S15, S16, S17 Test Plan	O
S17	9	PRP	System	Potential unprotected burn hazards	#			S10, S11, S15, S16, S17 Test Plan	O
<b>KEY</b>									
X	Does not meet expectation								
Δ	In Progress-Undetermined if specification is met								
O	Meets specification								

<b>Team #:</b>	P17487	<b>Team Name:</b>	KonTiki Kiln Heat Recovery System				
<b>Date:</b>	1/25/2017	<b>Document Owner:</b>	Eta				
<b>Revision #:</b>	3						

<b>Subsystem Name:</b>	Time and amount of heat used by recovery system to obtain ideal water temperature
<b>Date Completed:</b>	4/9/2017
<b>Performed By:</b>	Team
<b>Tested By:</b>	Team

## S4, S7, S8, S9 Test Plan

Concluded condition of meeting Engineering Specification

### I. TESTING SPECIFICATION

Specification Number	Importance	Source	Function	Specification (Metric)	Unit of Measure	Ideal Value	Marginal Value	Comments/Status
S4	9	PRP	System	Time	Minutes	120	180	O
S7	9	PRP	System	Time	Minutes	<60	<120	O
S8	9	PRP	System	Energy	KJ	>8000	>4000	O
S9	9	PRP	System	Volume	Liters	>5	8	O

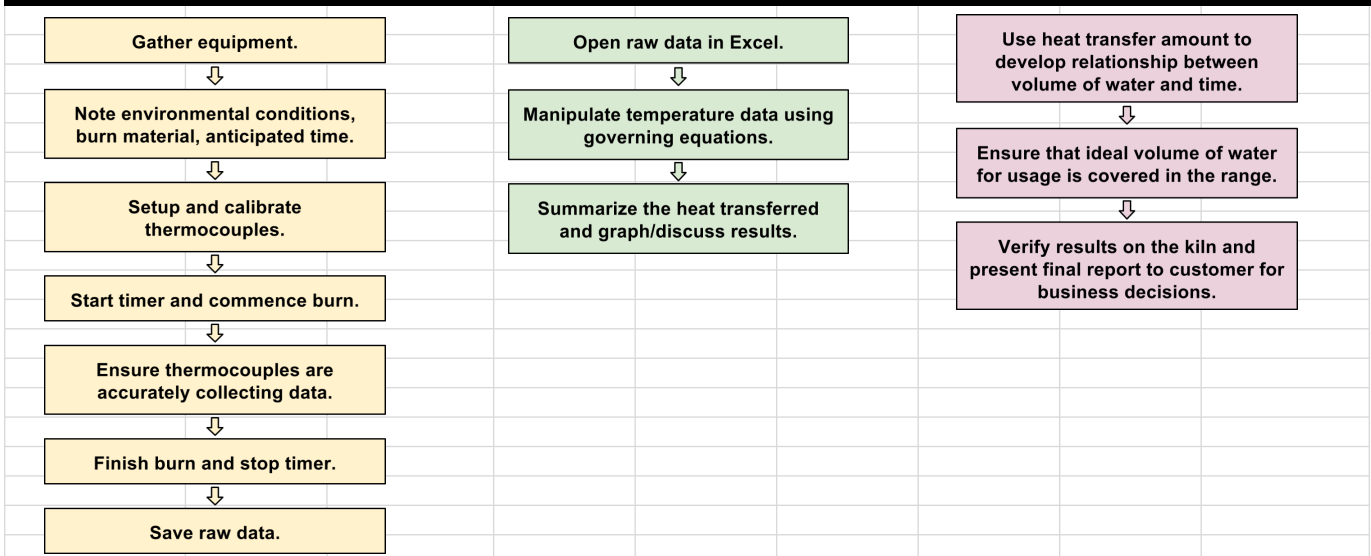
### II. EQUIPMENT REQUIRED

Specification Number	Description of Equipment
S4	Timer
S7	Heat recovery system, kiln, burn material, thermocouples
S8	Excel, ANSYS
S9	Heat recovery system, kiln, burn material, thermocouples

### III. DATA COLLECTION STRATEGY

Specification Number	Data Acquisition Strategy
S4	Begin timer at ignition. Stop timer at quench. Note how full the kiln is after quenching. Average time values taken from each burn by burn "size".
S7	Set up thermocouples as shown in section IV. Begin start time. Note weather and burn conditions throughout the cycle. Record data and analyze for section V. Ensure consistent environmental conditions during each test, if possible.
S8	Analyze raw data in post using governing equations to obtain the amount of heat recovered.
S9	From raw data, use the amount of heat transferred to predict the relationship between time and volume of water. Verify with follow-up testing on the kiln.

### IV. TESTING FLOWCHART



### V. RAW DATA ACQUISITION

S4		
<b>Start time</b>	10:08:00 AM	
<b>End time</b>	10:46:00 AM	
<b>Burn time duration</b>	38.00	Minutes
S7		
<b>Starting water volume</b>	14.22	gal
<b>Time to heat to ideal temperature</b>	30.5	Minutes

S8

Heat Recovered

Specific Heat Coefficient, Water	cpw	4180	J/kg°C	
Water density	ρw	998	kg/m³	*Corresponding to starting water temperature
Starting volume of water	Vw	0.05382	m³	
Mass of water	mw	53.71236	kg	*Assumed mass stays constant during entire burn
Starting water temperature	Tc	15	°C	
Ending water temperature	Tf	42	°C	
Total time	t	2280	sec	
	qtransferred	6061.97695	kJ	
	qdot	2658.76182	W	

Total heat transferred based on control volume analysis.

S9

No delta from last test.

**VI. RESULTS**

All tests passed and met specification.

**VII. CONCLUSION**