



Test Plans for B-9

Power Output Test Plan

Power Indication Test Plan

Flywheel Endurance Test Plan

Manual Input (Ergonomic) Test Plan

Test #	Component / System Tested	Description	Engineering Spec	Pass/Fail Criteria
1	Buck Circuit	Measure power from supply lines	4	≥ 17 watts

Test #	Result	Pass/Fail?	Comments
1			

Failure: **Yes** **No**

Comments/Observations: _____

Test #	Component / System Tested	Description	Engineering Spec	Pass/Fail Criteria
1	Voltage comparator	Voltage at which the low end red LED energizes, indicating the need to crank faster	4	11.5V
2	Voltage comparator	Voltage at which the green LED energizes, indicating crank speed meets requirements	4	12.5V
3	Voltage comparator	Voltage at which the high end red LED energizes as voltage increases, indicating crank speed is too fast	4	13V

Test #	Measured Result	Pass/Fail?	Comments
1			
2			
3			

Failure: Yes No

Comments/Observations: _____

Better Water Maker: Flywheel Test

This test is designed to verify that the flywheel is structurally sound when in operation. The centrifugal force of the sand or dirt filler located inside the flywheel will develop stresses on the outer wall of the flywheel. Also, the flywheel will experience inertial stresses from rotating at a maximum of 4 revolutions per second, or 240 rpm. The rotational velocity of the flywheel will be increased to 4 revolutions per second while attached to the hand crank, and maintained for a specified amount of time. The flywheel will then be inspected to ensure that structural integrity is maintained and no fractures have developed or cracks propagated. The test setup shall be inspected for defects, which will be recorded below. In the event that the test does not pass all requirements, actions will be taken to verify that the flywheel is operating as expected.

This test will also examine whether the cost constraints of the manual power generation unit are met. The cost of the unit will be determined by summing the cost of the components the makeup the flywheel, shaft and handles. The cost is to be less than \$50.

Equipment Needed:

1. Flywheel
2. Drive Crank
3. Timer

Resources Needed:

1. Sand or dirt to fill flywheel

Start Date:

Finish Date:

Engineer set-up experiment: Robert Zwecker

Assistant:

Are there any visual defects before testing: **Yes** **No**

If yes then Explain: _____

Test #	Component / System Tested	Description	Engineering Spec	Pass/Fail Criteria
1	flywheel	flywheel is structurally sound at maximum operating speed	11	Structural integrity maintained at 240 rpm
2	Manual power generation unit with flywheel	Determine the cost of the manual power generation unit and flywheel	1	≤ \$50

Test #	Result	Pass/Fail?	Comments
1			
2			

Failure: Yes No

Comments/Observations: _____

Better Water Maker: Manual Input Test

This test is designed to verify the amount of energy needed from the customer to operate the manual powered device. This test provides the effort, Kcal and respiratory exchange ratio (RER) required to perform the task. Ideally, operating the device would be an aerobic task, an RER below 1.00, instead of an anaerobic task. RER indirectly shows the muscle's oxidative capacity to get energy. Anything over 1.00 is considered anaerobic and therefore is not sustainable for more than a short period of time. RER will be determined using a VO₂ analysis, which measures the oxygen required to perform the task. The VO₂ analysis will also be used to determine the work, in Kcal, needed to perform the task. The current device requires roughly 16 calories/min to operate, comparable to a 155 lb individual running 8 miles per hour.

This test will also measure the training time required to operate the device. The device must be easy to learn how to be used, thus, training time shall be minimized. Individuals who are unfamiliar with the operation of the device will be briefed and then operate the device to determine the training time. This test will also measure the time required to install and setup the device for operation.

The test setup shall be inspected for defects, which will be recorded below. Upon Failure an investigation will be conducted to determine the cause of failure and a new solution will be pursued.

Equipment Needed:

1. Power Supply
2. VO₂ Measurement Equipment
3. Computer
4. Heart Monitor
5. Manual Power Device

Resources Needed:

1. Room with Open Space
2. People with varying levels of fitness

Start Date:

Finish Date:

Engineer set-up experiment: Andrew Sullivan

Assistant:

Are there any visual defects before testing: **Yes** **No**

If yes then Explain: _____

Test #	Component / System Tested	Description	Engineering Spec	Pass/Fail Criteria
1	Manual Device	Effort required	7	< 1.00 RER
2	Manual Device	Calories Burned	5	< 150 calories/gallon
3	Better Water Maker System	Training time required to operate device	8	< 5 minutes
4	Better Water Maker System	Time required for installation and setup	6	< 30 minutes

Test #	Measured Result	Pass/Fail?	Comments
1			
2			
3			
4			

Failure: **Yes** **No**

Comments/Observations: _____

