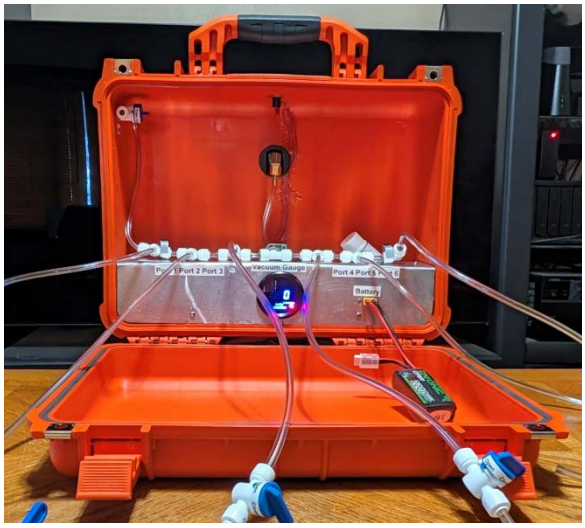
Mark 1
Marshmallow Crusher
Manual



Introduction

The Mark 1 Marshmallow Crusher is designed to crush up to 6 marshmallows at a time. The battery should be a 3S LiPo with as much capacity as desired. When built, two 2200mAh batteries were supplied. A 2200mAh battery should run the pumps for 2 hours continuously. Assuming a 33% duty cycle, running 1 minute out of every 3 minutes, a single battery should last about 6 hours. The digital vacuum gauge uses 20mA and should not significantly reduce the run time of the Mark 1 Marshmallow Crusher.
Do not discharge battery below 9.9V total or 3.3V per cell.

Contents

1. Battery charger, power cord and 2 batteries inside the battery charger box.
2. 6 vacuum jars, vacuum plates and associated hoses and valves.
3. Instruction manual.
4. Tube of food grade silicone grease. Probably not needed, but might aid in sealing vacuum jars with very thin coat on edge of vacuum jars.

Theory

Marshmallows have pockets of air inside their tasty little skins. The skin keeps the air trapped. The pressure of the air inside the marshmallow is whatever the atmospheric pressure was the day it was made. The marshmallow skin is not very strong. As the atmospheric pressure changes around the marshmallow, the air pockets will expand or contract.

The vacuum pumps remove the air in the vacuum jar. The air pockets expand, tripling the size of the marshmallow, until they exceed the strength of the skin. At that point the air pockets pop and the elasticity of the marshmallow collapses back down to its original size.

Now the air pockets have low pressure inside them. There is a vent to crush all marshmallows at once. When opened, atmospheric pressure is restored inside the vacuum chamber. Due to the low pressure inside the air pockets, the marshmallow is crushed.

Preparation

1. Ensure that batteries are charged before event.
    a. There is a battery charger and power cord. Plug the cord into a wall outlet and into the charger.
    b. There are two battery ports on the charger. The smaller one is for 2S batteries an is not used. Plug a battery into the larger 3S port.
    c. The lights show the status of each of the 3 cells in a 3S battery. Red lights are charging and green lights are charged.
    d. Once all three green lights turn on, the battery is charged.
    e. A completely dead battery should take about 3 hours to charge.

2. Have a good supply of marshmallows. Older sticky marshmallows will work. They just make a mess. New ones are better. Keep marshmallows in an air tight bag to prevent moisture from making them sticky.

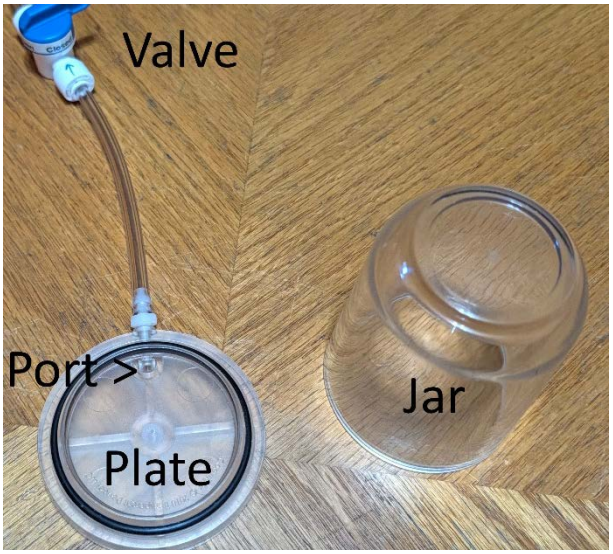


Figure 1 Vacuum Jar Parts

Setup

1. Open box
2. Use the battery charger box to prop up the large side of the box while placing the lid flat on the display surface.
3. Arrange the six vacuum lines, valves and vacuum plates as desired.
4. Plug in the battery into the battery port. The digital vacuum gauge should light up showing 0 vacuum.

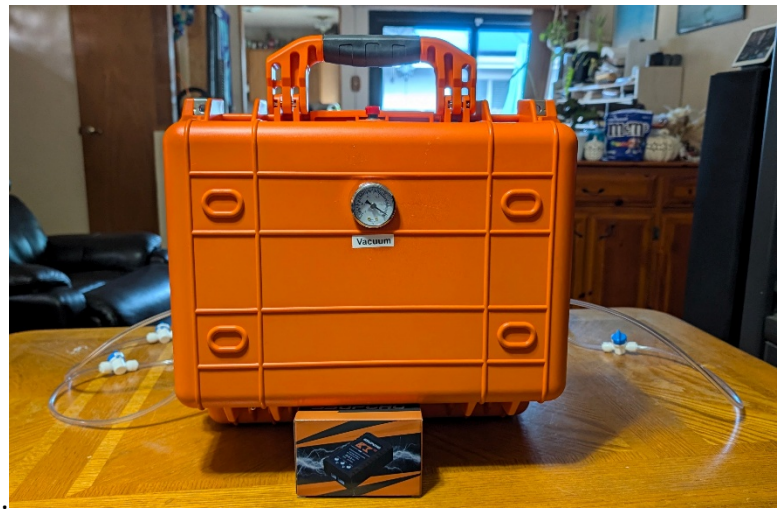


Figure 2 Back with Battery Box Prop

Testing

1. Ensure all valves are in the closed position.
2. Push the pump Vacuum On button located near the handle of the box.

3. Low noise of pumps running should be heard.
4. The vacuum should increase on both the mechanical (-27”) and digital (-30”) vacuum gauges.
    a. If vacuum does not increase, check for open valves.
    b. Check for leaking hoses. Use fingers to cover suspected leaks.
5. Place vacuum jar on vacuum plate and open vacuum valve to the jar.
    a. Vacuum should drop briefly and return.
    b. Test the next jar.
6. Once all jars have passed,
    a. Release the pump power button.
    b. Open the vent valve.
    c. All jars should be loose.
    d. Close all valves and system is ready for use.

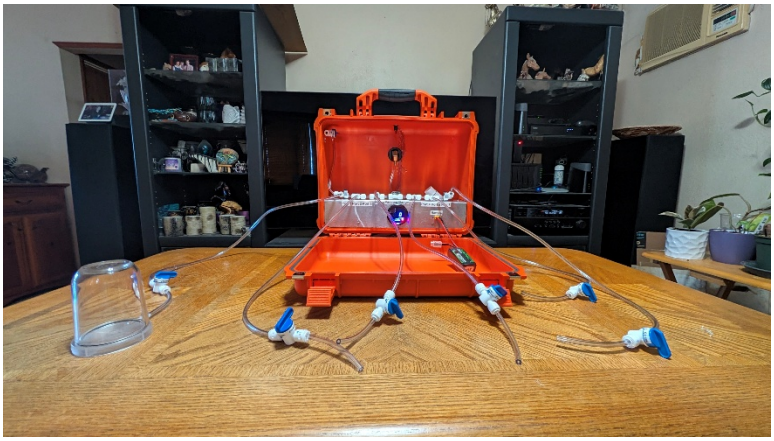


Figure 3 Case Ready for Use

Operation

1. Verify all valves are closed.
   It is possible to work with all vacuum jar valves open but will likely take more time due to requiring all jars to seal before a vacuum can be drawn.
2. Place marshmallow on vacuum plate. Avoid covering vacuum port on plate.
3. Place jar on top of plate. Ensure jar is centered over the plate and level. Not up on one side.
4. Start drawing a vacuum.
5. Once a vacuum is established, open the vacuum valve to one vacuum jar. The sudden vacuum should easily seal the jar to the plate. Vacuum will drop while the jar is being vacuumed.
   Note: If leaving all vacuum valves open all the time, all jars must seal before a vacuum can be drawn and it will take longer to draw the vacuum. Jars will likely require holding down to establish a seal.
6. Once vacuum is reestablished, open more vacuum valves.
7. Once vacuum has stabilized, release the pump power button.
8. Open the vacuum vent valve to crush all the marshmallows.
9. Repeat as desired.

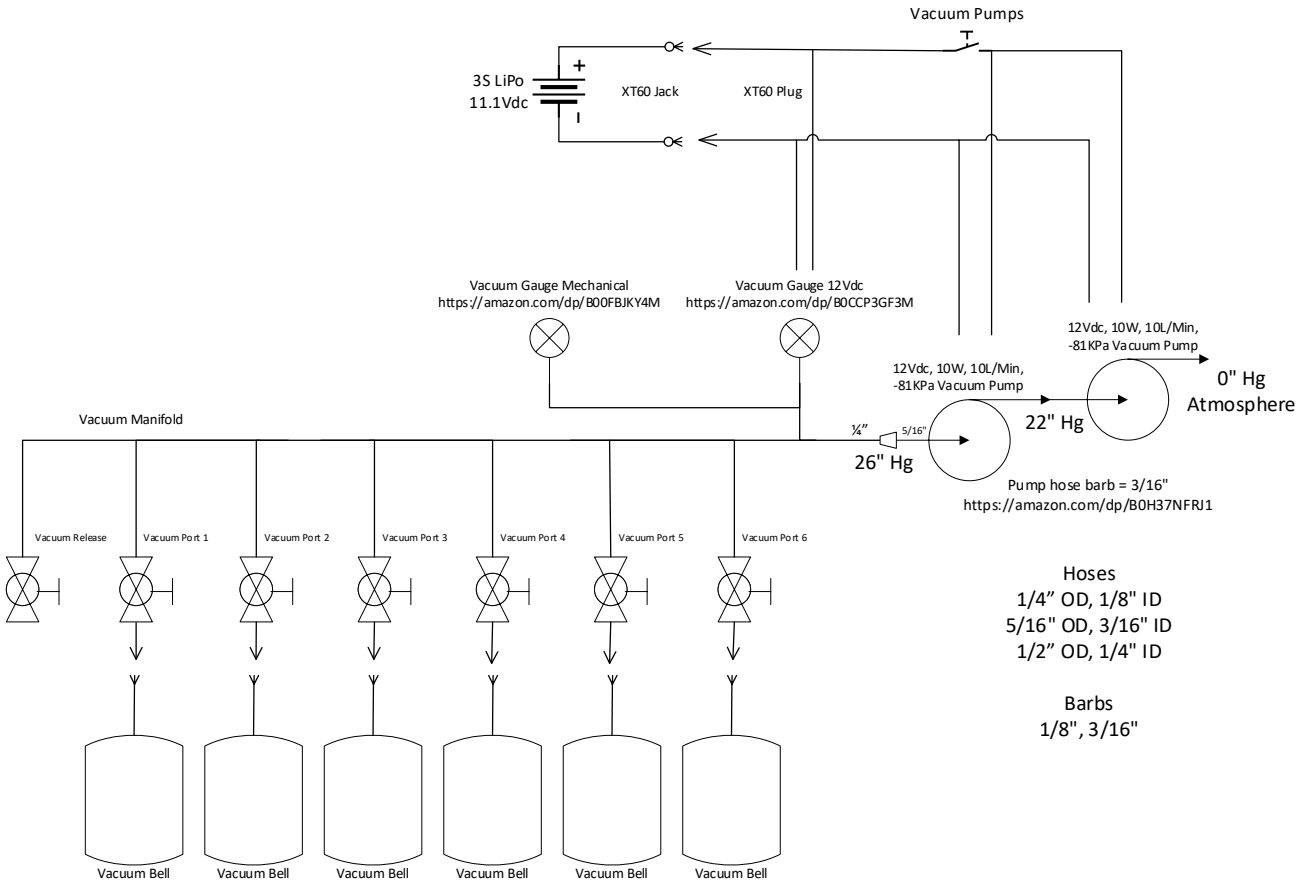


Figure 4 Mark 1 Marshmallow Crusher Functional Diagram

Tear Down

1. Remove battery charger box from under case.
2. Lay box with large side down.
3. Place battery in battery charger box and place box in case.
4. Stack vacuum jars inside each other and place in case.
5. Coil vacuum lines, valves and vacuum plates in case.
6. Close and latch case cover.



Figure 5 Packed Case

Battery Checker



Figure 6 Battery Checker

This checker works with any 1-8S LiPo battery. It reads individual cell voltages, and whole pack voltage. There is a low voltage alarm that will sound when the pack gets too low. The alarm voltage can be set by pressing the button on top of the unit. The voltage the alarm will sound is adjustable between individual cell voltages of 2.7v and 3.8v in .1v increments (3.3v is the default).

How to use:

Insert the white balance charging plug of the battery into the checker with black wires to the left and red wire to the right starting at the left edge of the checker with the digital side up. The checker will scream loudly twice, and the number of cells will be displayed on the screen.

There is a small button at the top of the checker that is used to set the alarm voltage. When the voltage is lower than the set value, the buzzer will sound and the red LED will flash. The default setting is 3.3V. Press the button to change the voltage setting.

Note: When the voltage is below the set value, the buzzer will sound along with a red LED light.
Do not discharge battery below 9.9V total or 3.3V per cell.

Specifications:

Use for testing 1-8S, LiPo/Li-Ion/LiMn/Li-Fe batteries
Voltage Detection Precision: +/- 0.01V
Unit Voltage Display Range: 0.5 - 4.5V
Total Voltage Display Range: 0.5 - 36V
1S Test Mode Voltage Range: 3.7 - 30V
Alarm Set Value Range: OFF, 2.7 - 3.8V