

# Hyper-Sonic Shock Tube Guidelines and Procedure

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## Safety Guidelines For Shock Tube

1. Vent any gas in the adjacent shock tube by opening it's release valve for 30 seconds and then close the valve
2. Ensure no one is in the room with shock tube when it is being fired
  - (a) Vacate the entire lab and close all doors
  - (b) Turn on warning lights
  - (c) Warn everyone around you that the shock tube is being fired
  - (d) Do not leave the person controlling gas cylinder unattended
  - (e) **Do not operate shock tube while in the same room**, leave room with shock tube in it to operate
3. In case of no vacuum, leave the chamber door open
4. If there is a vacuum, double check the vacuum chamber door is closed tightly and the valve between the vacuum chamber and pump is closed
5. Make sure mylar bolts are completely tightened
6. Make sure the valve to the hyper-sonic shock tube is open
7. Double check to make sure no one is in the big tank
8. Check to make sure door to outside is closed and locked
9. Be sure to yell "firing" when releasing gas and also around the pressure where the diaphragm is expected to burst
10. **If for any reason someone opens a door or comes into the room with hyper-sonic shock tube shut off gas immediately and ask person to leave**

## Procedure for Running a Safe Hyper-Sonic Shock Tube Experiment

1. Connect the sensor BNC cable to the sensor signal conditioner and connect the BNC cable from the sensor signal conditioner to the oscilloscope
  - (a) Make sure all cables work appropriately and that there is little to no noise from the sensors on the oscilloscope
  - (b) Set the oscilloscope to the proper scaling and add an appropriate trigger for the experiment
2. Loosen bolts around the connector between the driver and driven section until you are able to slide open the sections to replace the mylar
  - (a) Before replacing the mylar make sure there is no pressure inside the hyper-sonic shock tube by opening the atmospheric pressure valve and then make sure it is closed for experiments
  - (b) The mylar should be placed over the diameter of the inner tube and clamped tightly between the two sections.
  - (c) Ensure the bolts are properly tightened and the mylar is clamped correctly
3. When applying the vacuum to vacuum chamber, close the vacuum chamber door and hand tighten the door handle. Open the valve to the vacuum pump and turn the pump on. Once it has reached the appropriate vacuum pressure for the experiment close the valve to the pump and turn the pump off
  - (a) If there is no vacuum,leave vacuum chamber door open to avoid any failure in the handle
4. Once the hyper-sonic shock tube is set up and ready to fire, clear the room and shut all doors. Set the oscilloscope to trigger and double check the vacuum pressure before leaving the room.
  - (a) When leaving the room ensure that no one else is in the lab with the shock tube and close all doors and follow all safety guidelines.
5. Once everyone including person operating the shock tube has left the room, start the firing process.
  - (a) Turn on the digital pressure sensor and make sure it is set the proper units, psi.
  - (b) Be sure to yell "firing" and open the gas canister for either the helium or nitrogen cylinder.
  - (c) Open the valve to the shock tube and slowly turn the knob until you hear the mylar burst and then quickly close the valve.

6. Once the mylar burst and the valve is closed, close the gas cylinder and slowly open the valve to release the pressure. Then close the valve and loosen the knob on the canister
7. Turn off the warning lights and enter the room to release any vacuum that may be left in the vacuum chamber and open the atmospheric pressure valve to release any pressure or gas
8. Remove/replace the mylar and check the oscilloscope to save the data
  - (a) Go to File in the top left corner of oscilloscope and go to **Save As**.
  - (b) Make sure to click waveform and save as a .csv file.
  - (c) Make sure to save **ALL** channels and go into the directory to save it to the proper **USB** or location.