

# HIGH STRAIN RATE MATERIAL TESTING



**Split Hopkinson  
Pressure Bar**



## SHPB Strain Gage Application Instructions

## D Appendix A: Strain Gauge Application

### Split Hopkinson Pressure Bar (SHPB) - Strain Gauge Application

#### Materials required:

- |                        |   |
|------------------------|---|
| ✓ Acetone              | ✓ Electrical Tape                       |
| ✓ Gauze Pads           | ✓ Strain Gauge(s)                       |
| ✓ Tweezers             | ✓ Strain Gauge wire                     |
| ✓ 6"x6" Plexiglass     | ✓ Wire Strippers                        |
| ✓ Clear Tape (2" wide) | ✓ 400-600 grit sandpaper                |
| ✓ Super Glue/M-Bond    | ✓ Chassis                               |
| ✓ Soldering Iron       | ✓ Vishay Instruction Bulletin #B-127-14 |
| ✓ Razor Blade          |   |

#### Procedure:

1. Identify proper strain gauge location (on both Incident and Transmission Bars).  
As a General Rule the Strain Gauge will be located a minimum of double the length of the longest striker bar, away from the Specimen Point of Incident. Strain Gauges on both the Incident and Transmission bars will be located at the same distance away from the Specimen Point of Incident (i.e.: if the Incident bar strain gauge is 36" from the Specimen Point of Incident then the location of the Transmission bar strain gauge will be at that distance also). For reference: on a 6 foot long bar the strain gauge(s) will be located 3 feet from the Specimen Point of Incident and 48 inches (4 feet) on an 8 foot long bar.

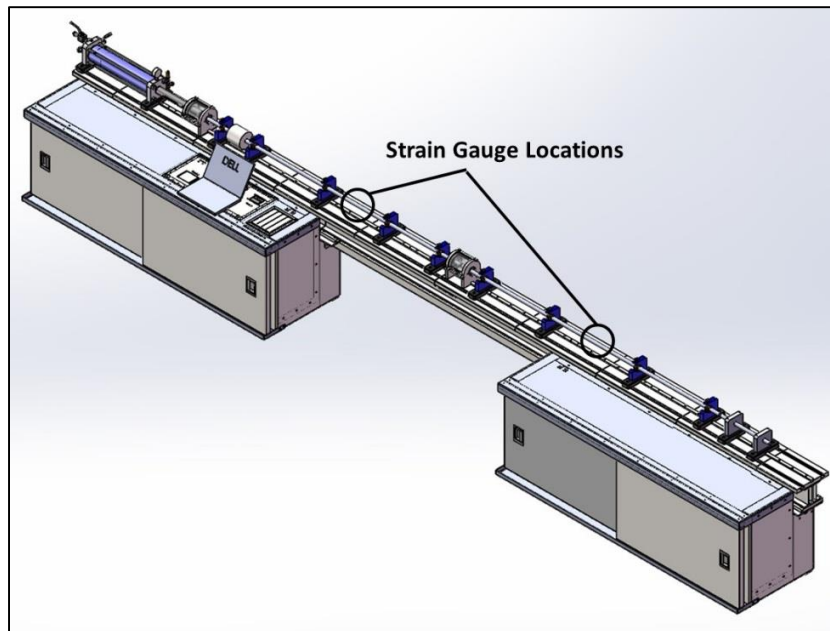


Figure 39: Locating Strain Gauges

2. With proper strain gauge location(s) identified, move bar stands, if necessary, to accommodate the strain gauge.
3. Area Prep: Use 400-600 grit sandpaper to remove any residue on bar at the strain gauge location (an area approximately 3" long)
4. Initial Cleaning: Apply acetone on gauze pad and wipe on bar to clean sanded area

5. Second Cleaning: Spot clean exact area where strain gauge is to be applied with a new clean gauze pad and acetone
6. Final Cleaning: At area of strain gauge application you will wipe area 3 times. Each successive time will use a new gauze pad. Each time you wipe in one direction and begin the wipe within the previously cleaned area as not to pull new contaminants into the cleaned application area. Each successive wipe will be shorter than the wipe preceding it.
  - a. 1<sup>st</sup> wipe/cleaning pass: 3" long strip
  - b. 2<sup>nd</sup> wipe/cleaning pass: 2" long strip
  - c. 3<sup>rd</sup> wipe/cleaning pass: 1" long strip
7. Mark exact location of front edge of strain gauge on bar with a fine point permanent marker. Place mark outside of cleaned area. Mark will be used as a reference point when applying strain gauge to bar. **DO NOT PLACE GAUGE ON MARK.** Important: Record measurement from bar end (Specimen Point of Incident) to leading edge of strain gauge for use in REL's SURE-Pulse Software

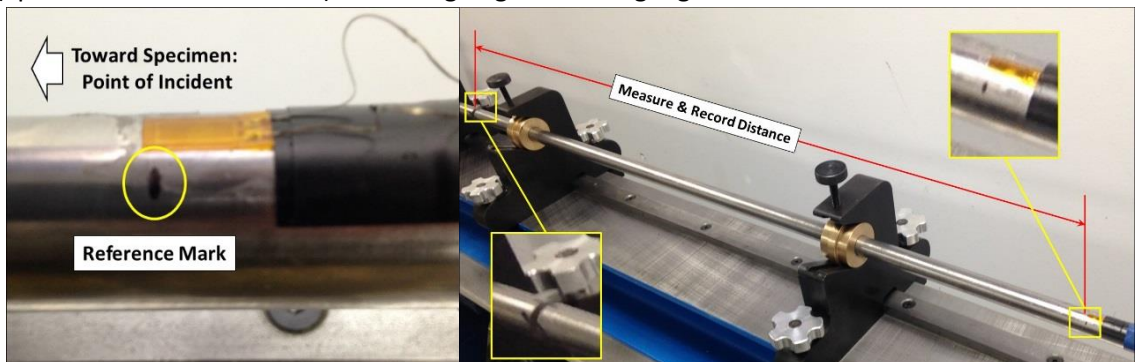


Figure 40: Marking & Recording Front Edge of Strain Gauge

8. Clean 6" Long x 6" Wide piece of plexiglass using Step #3 through Step #5 above
9. Use tweezers to remove strain gauge from package of gauges. Grab gauge by leads (wires). Do not touch the gauge's foil resistor. Important: always handle strain gauge with clean tweezers to avoid contamination of gauge.

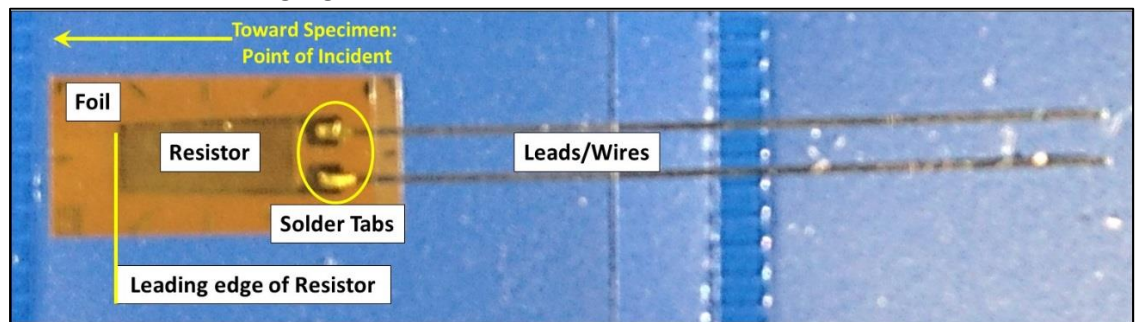


Figure 41: Strain Gauge Detail

10. Locate lead soldering tabs on strain gauge. Set Strain gauge on cleaned piece of plexiglass with soldering tabs facing up. (Soldering tabs will be 2 small bumps connecting resistor to lead (wire) on the strain gauge foil: See Diagram in Step #8)
11. Rip 3" piece of clear tape & fold over one end to make a small tab (small tab will assist in removing tape later)
12. Place 3" piece of tape completely over strain gauge which is setting upon plexiglass. Place small tape tab away from leads (wires) end of strain gauge. Rub top of tape to remove any air bubbles and to completely adhere tape to plexiglass over strain gauge.

13. Carefully pull on small tape tab to remove tape from plexiglass (which in turn will lift strain gauge off of plexiglass surface), while still allowing strain gauge to remain stuck to tape. Locate strain gauge (on sticky side of tape) onto the bar. Make sure strain gauge is parallel with axis of the bar. Locate leading edge of resistor to measured mark on bar. Place the foil resistor end of the strain gauge towards the Specimen Point of Incident and the strain gauge leads (wires) away from Specimen Point of Incident. Do NOT place foil resistor on reference mark as mark will leave a contaminating film on strain gauge. Carefully adhere tape to bar gently rubbing thumb over strain gauge.
14. Pull small tape tab carefully back toward leads (wire) end until the entire strain gauge foil is off of bar. Do not pull farther than the back edge of the resistor foil as the leads (wires) need to remain stuck to bar to ensure proper alignment.
15. Place dot (approximately 1/4" in diameter) of superglue on bar at bend of tape (back edge (lead/wire end) of resistor foil. Note: if using M-Bond follow M-Bond directions.
16. Place base of thumb over top of lead (wire) of strain gauge and roll thumb forward, toward and through, the leading edge of strain gauge foil resistor. Pressing strain gauge foil (still attached to clear tape) onto superglue in only forward direction. Roll and hold, do NOT rub across strain gauge. Rolling thumb will spread superglue over the entire foil resistor and ensure a complete bond to bar.
17. Hold thumb over entire strain gauge (with pressure) for at least 120 seconds (2 minutes) to allow superglue to set/cure/dry. Note: deliberately rolling thumb and then holding with pressure allows for a thin film of glue to be evenly distributed between strain gauge foil and bar thus eliminating any dampening effect from the glue.
18. Slowly & carefully pull small tape tab towards lead (wire) end of strain gauge, removing tape from gauge (strain gauge is now adhered to bar with the superglue) and bar. Gauge must stay glued completely to bar, if strain gauge begins to peel up with tape it must be removed and the process needs to begin again.
19. Place electrical tape at very end (lead/wire end) of resistor foil, sliding tape under the 2 leads (wires) to prevent contact of bare leads (wires) with bar. Contact of bare leads (wires) with bare bar will ground out signal and will not allow for proper test. Place tape successive pieces of tape under wires to ensure no contact between bare wire and bar. Ensure that the leads (wires) do not make contact with the bar OR each other.

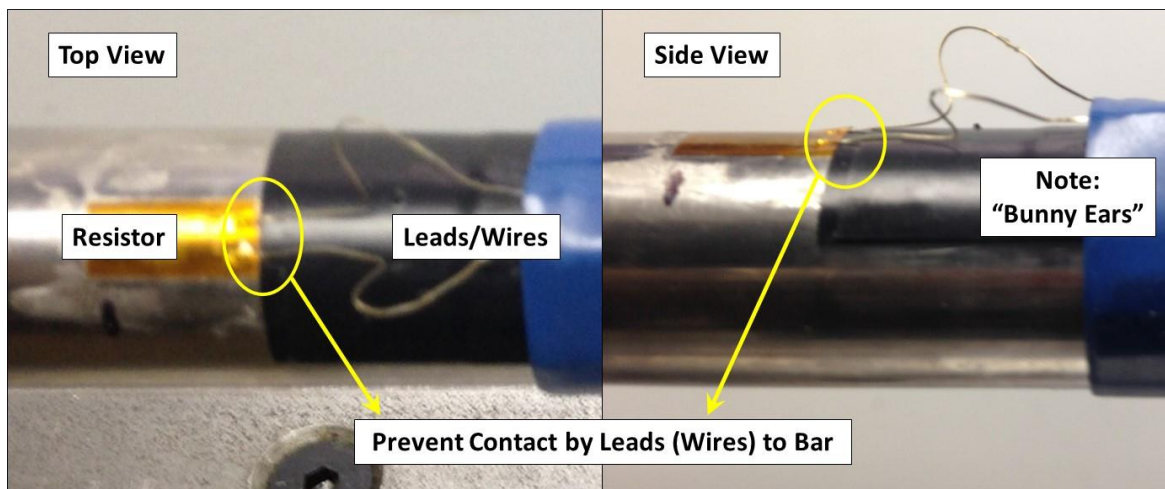


Figure 42: Completed Strain Gauge Application

20. Solder shielded strain gauge wire to leads (wires) on strain gauge (refer to Vishay diagram)
21. Tape soldered strain gauge wire securely to bar using colored electrical tape. Use BLUE tape for Incident bar and RED tape for Transmission bar. Note: Leave “bunny ears”, loop excess lead (wire), when securing strain gauge to bar.