Standard Operating Procedure

Piston Cylinder

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| **Department:** | Earth and Environmental Sciences |
| **Date SOP was written:** | 9/19/2013 |
| **Date SOP was approved by PI/lab supervisor:** | 9/19/2013 |
| **Principal Investigator:** | John Ayers |
| **Internal Lab Safety Coordinator/Lab Manager:** | Richard Bradshaw |
| **Lab Phone:** | Click here to enter text. |
| **Office Phone:** | J. Ayers (615) 322-2158 (campus phone: 2-2158) Bradshaw (615) 343-0839 (campus phone: 3-0839) |
| **Emergency Contact:** | J. Ayers (615) 973-1879  R. Bradshaw (208) 260-2792 |
|  |
| **Location(s) covered by this SOP:** | *SC 5712* |
| *(Building/Room Number)* |

**Type of SOP:** ☒ Process ☐Hazardous Chemical ☐ Hazardous Class

**Purpose**

**Personal Protective Equipment (PPE)**

**Respirator Protection**

**Eye Protection**

ANSI approved, tight-fitting safety glasses/goggles and/or face shield.

**Body Protection**

Remove any loose jewelry around your neck or any jewelry on your hands and wrists. Tightly secure long hair in ponytail.

**Ear Protection**

Ear protection in the form of ear muffs or ear plugs must be worn during operation.

**Engineering Controls**

**Medical Emergency**

To contact the [Vanderbilt University Police Department](http://police.vanderbilt.edu/) in an emergency:

* Call **911** from any campus phone.
* Call **(615) 421-1911** from any other phone.

**Protocol/Procedure**

**Report any problems or abnormalities with the equipment immediately to the PI or LM.**

**\*\*\*NEVER leave the machine unattended while operating\*\*\***

1. Prepare sample assembly – Don’t forget lead foil and base plug.
2. Place the bridge on bottom ram and slowly insert the tungsten carbide pusher.
3. Insert the donut in the bridge so that it is level.
4. Coat the protruding sides of the donut well enough so that the gap between the donut & bridge is not visible.
5. Slide the piston (right side up) down into the donut.
6. Place the pressure vessel onto the bridge, centered over the piston.
7. Gently lower the sample assembly into the pressure vessel and make sure that the lead jacket does not tear.
8. Insert the base plug slowly.
9. Close the upper ram valve and open the lower ram valve. Close the pump valve and use the pump to slowly raise the assembly until it is flush with the top of the pressure vessel.
10. Center a 7-inch mylar sheet on the pressure vessel and fasten with double sided tape. Make sure to center the hole of the mylar sheet around the stainless steel of the base plug.
11. Coat the thermocouple (tc) plate with the copper lubricant paste and make sure that the O-ring is seated.
12. Using the 1/16 drill bit, center the tc plate over the base plug. Make sure that the drill bit moves easily in and out of the holes. Make sure that the tc plate does not contact the pressure vessel, but rather, the mylar sheet.
13. Insert the thermocouple ceramic through the holes and make sure that is moves through the tc plate, through the hole in the base plug, and through the upper ceramic piece in the sample assembly.
14. Prepare thermocouple – Make sure that the thermocouple insulator is not too long!
15. Move the Teflon tubing down to the thermocouple insulator, so that the wires do not touch.
16. Make sure the thermocouple works (by attaching leads from t controller, or using the voltmeter to check continuity). Carefully lower the slotted plate onto the tc plate, make sure that it is centered and that the thermocouple wires move freely, or else the thermocouple insulator will break.
17. Center the top spacer on the slotted plate without moving the slotted plate. If the slotted plate moves, the ceramic thermocouple insulator will break.
18. Place two four-inch mylar sheets between the top spacer and the top ram.
19. Close the lower ram valve and open the upper ram valve. Slowly pump until the pressure on the top left gauge equals 8000 psi.
20. Close the upper ram valve, then bleed off the line pressure by opening the pump valve.
21. Close the pump valve before opening the lower ram valve the second time.
22. Connect the water hoses.
23. Connect the electrical leads.
24. Open the lower ram valve, and **slowly** raise the pressure to 2000 psi. The pyrex sleeve will fracture, so make sure to do it slowly.
25. Open the water valve and close the air valve.
26. Turn on the water.
27. Lift the knife switch on the circuit breaker to “On”.
28. Press and hold the button on the flow switch and press the “Start” button on the circuit breaker until water flows into the sink, then release the button.
29. Place the hose well into the drain and secure it with the rock in the sink.
30. Hit run on the temperature controller.
31. When increasing the pressure of the run after it’s begun:
    1. Tighten the pump valve, so that it can pump.
    2. Pump up pressure in the line until it can no longer be pumped.
    3. Open the lower ram valve slowly.
    4. Increase pressure.
    5. Close lower ram valve slowly.
    6. Open pump valve.

**NOTE**

Any deviation from this SOP requires approval from PI.

**Documentation of Training** (signature of all users is required)

* Prior to conducting any work with the Piston Cylinder, LM or designated personnel must provide training to his/her laboratory personnel specific to the hazards involved in working with this substance, and emergency procedures.
* The Principal Investigator must provide his/her laboratory personnel with a copy of this SOP.
* The Principal Investigator must ensure that their laboratory personnel have attended appropriate laboratory safety training and are current with any refresher training required.

I have read and understand the content of this SOP:

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| **Name** | **Signature** | **Identification** | **Date** |
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