

SOP for loading tensile bars to load frame and sealing the auto clave pressure vessel

1. Clean tensile bars in acetone with ultrasonic cleaning for 5 minutes, then ultrasonically clean again for 5 minutes in methanol.
2. Load cleaned tensile bar to the load frame (tighten the nuts).
3. Place the seal gasket in position (Flat surface down and curved surface up **VERY IMPORTANT**).
4. Set the software on the computer to control the tensile stress as 4 lb.
5. Use the lifting crane to move the top lid of pressure vessel to seal the vessel.
6. Tighten the bolts (follow the sequences) to 150 foot-pounds. (Make sure both male and female threads are cleaned)
 - a. Follow the numbering on the bolts.
7. Tighten the bolts (follow the sequences) to 200 foot-pounds.
8. Tighten the bolts (follow the sequences) to 250 foot-pounds for **TWO** rounds.
9. Place the extensometer into position under the pressure vessel.

SOP for feeding water into the pressure vessel

1. Make sure at least 5 liters of water are in the water column.
2. To fill water in the pressure vessel: V10 open, V11 close, V14 close, V13 open, V12 open and V15 open.
3. Turn off HIP release valve connected to the bottom of pressure vessel, otherwise water in the pressure vessel will be drained by the release valve.
4. Use the control board to change the flow rate to 200-300 milliliter per minute.
5. Tape High Pressure Pump on button on the control board. Water starts being pumped into pressure vessel. Water is slowly fed in from the bottom of the pressure vessel.
6. Air bubbles can be seen in the flow meter next to Back Pressure Regulator as water being pumped into pressure vessel.
7. When significant amount of bubble coming through the flow meter, this means water and air were simultaneously pushed out through the feeding tube in the pressure vessel. This means it is time to feed water from the feeding tube.
8. Change the flow rate to 100 milliliter per minute.
9. Turn off the High Pressure Pump for a moment.
10. To feed water from the feeding tube: V10 close, V 11 open, V 12 close, V13 open, V14 open and V16 open.
11. Turn on the High Pressure Pump.
12. Now water pressure is slowly building up in the pressure system.
13. Slowly close Back Pressure Regulator. This will increase the water pressure flow into the pressure vessel. Keep the metal ball in the flow meter at around 50 milliliter per minute.

14. Slowly close Back Pressure Regulator till the system pressure achieving 1500 psi (simulating BWR) for example.
15. Wait till the feeding system stable. Check the water leakage in the gasket region (between vessel base and vessel lid) before cover the pressure vessel with insulators.

SOP for starting heat up the pressure vessel

1. Slowly slide the heating elements down and insert the thermal couple into the gap of heating elements.
2. Remove the hook shaped bolt on the top of the vessel lid and cover the pressure vessel with insulators.
3. Turn on city water cooling loop and turn on the cooling chiller.
4. Switch the knob on the chiller to Cooler water only. A clicking sound will be heard indicating now city water loop is cut but water in the chiller is now cooling the system. In some case if chiller is down, city water loop will take over cooling our system down.
5. Set Preheater to 310 C with 320 High limit. (Take target T of water in the pressure vessel 288 C as an example).
6. Turn on Preheater.
7. Set the target T to 288 in the software.
8. Turn on the heater (heating elements).
9. Adjust the gas flow into the water column to control the water chemistry.
10. Wait till the system stable.

SOP for starting the test

1. Input parameters of test into the software.
2. When the system is stable, hit the start test button.

SOP for unloading tensile bar from auto clave system

1. Click stop test button.
2. Turn off heater and preheater.
3. Wait until the system cool down.
4. When the system is cooled down to room T, open the Back Pressure Regulator slowly to release the water pressure.
5. Turn off the High pressure pump.
6. Turn off chiller and city water cooling loop.

7. Connect a line charged with 30 psi Argon to HIP water release valve.
8. To purge water out from the pressure vessel: V10 close, V11 close, V12 close, V13 open, V14 and V16 open.
9. Turn on the HIP water release valve, water purging is started.
10. Wait till see only gas running through flow meter.
11. Turn of the HIP water release valve. Disconnect the 30 psi supply line from the HIP water release valve.
12. Turn on the HIP water release valve. Now residue water will be purged out, use a container to collect water.
13. Close the HIP water release valve again. Now tensile specimen is ready to be unloaded.
14. Remove insulators covering the pressure vessel.
15. Slide the heating elements on and take the thermo couple out.
16. Remove the extensometer.
17. Tighten the hook shaped bolt on the top of the pressure vessel by hand.
18. Loose the bolts on the pressure vessel.
19. Lift the pressure vessel lid to the side of the pressure vessel base.
20. Unload the tensile specimen.
21. Let the vessel base dry in air.