Hydraulic Press: Safety Preparation

The hydraulic press, shown in figure 1 to the right, will be used to perform powder compaction. Before operating the press please take note of the following devices in order to familiarize yourself with the press for safe operation:

1. The manufacturer’s warning label clearly indicates that it is unsafe to operate this press in excess of 12 US-tons.

2. The circled lever to the right will be repeatedly actuated during the powder compaction process. Actuating this lever will force hydraulic fluid (oil at constant pressure) from the tank below the lever, through the hose and into the hydraulic cylinder at the top. It will become more difficult to actuate this lever at greater forces.

3. The increased hydraulic fluid in the cylinder will force the punch (circled) down. During powder compaction this punch will enter a die containing powder.

4. The gauge on top of the press will translate to the operator the force exerted on an object. A conversion table located near the press will translate force readings into pressure given the cross-sectional area of the punch. The gauge reads US-tons on the outer radius of the circular reading and metric-tons on the inner radius.

5. The hollowed out cylinder on the left in Figure 2 is the die.

6. The base plate is in the center of Figure 2 and is placed underneath the die. The shaft extending from the top of the base plate provides easy alignment with the die.

7. The basin is on the right side of Figure 2 and is used to eject the sample upon completing the powder compaction.
8. The load cell is shown in Figure 3. It sets in a machined out section of the black plate (attached to the work surface) and will provide highly accurate digital readouts of voltage corresponding to the force applied. These voltages can be translated into pressures using the conversion table mentioned above. The base plate will sit on top of the load cell. The lack of fit between the load cell and base plate is to Insure 100% of the force translates to the inner rod of the load cell, which is the location where force is detected.

9. Figure 4 reveals a locking mechanism, located on the inside of the safety door, that is used to keep the safety door in the open position while loading/unloading the sample. Simply actuate the knob counter clockwise to release the safety door.

10. A knob located on the side of the hydraulic tank below the lever is shown in Figure 5. This knob controls a one-way valve. When the knob is turned completely clockwise the one-way valve is active, only allowing hydraulic fluid to flow up into the hydraulic cylinder above. When the knob is turned entirely counter clockwise the one-way valve is disengaged and hydraulic fluid flows back into the tank below. This action releases all force that the press was exerting on the sample. The operator must release this stored pressure prior to opening the safety door.
Hydraulic Press: Standard Operating Procedures

Follow the steps below in order to safely operate the hydraulic press.

1. Insure the valve activation knob, mentioned in the safety preparation (and shown in Figure 1), is turned entirely counter clockwise. This will release any stored pressure from the system.
2. Open the Plexiglas safety door.
3. Two black plates are sitting on the work surface. One has a shallow circular offset (shown in Figure 2) in which the load cell is placed. Insure the load cell (shown in Figure 3) is sitting entirely within the offset circle.
4. Place the connected die and base plate (containing compressible powder) on top of the load cell, as shown in Figure 4.
5. Insure the punch (shown in Figure 5), the load cell, and the die/base plate are all vertically aligned.
6. Close the safety door by releasing the lock.
7. Turn the valve activation knob, shown in Figure 1 entirely clockwise to engage the one-way valve.
8. Begin activating the lever shown in Figure 6. Once the punch reaches the powder and compaction begins activating the lever will require more force.
9. Monitor the gauge above the press (shown in Figure 7) while actuating the lever. Continue actuation until you’ve reached the desired tons of force. Do not exceed 12 US-tons.
10. Upon reaching desired force allow the press to hold force for the desired time interval.
11. Release stored pressure by rotating the valve activation knob shown in Figure 1 entirely counter clockwise.

12. Open the safety door.

13. Lift die and base plate off of the load cell. Holding the two devices over a counter or table, separate the die from the base plate.

14. If the sample of compacted powder is lodged in the die follow the remaining steps in order to eject the powder compaction sample.

15. Place the basin into the offset circle as shown in Figure 8.

16. Carefully place the die on top of the basin as shown in Figure 9.

17. Shut the safety door and rotate the valve activation knob (shown in Figure 1) entirely clockwise.

18. Actuate the lever until the punch is nearly to the sample. Once the line on the punch (pointed to in Figure 10) nears the top of the die slow your rate of actuating the lever. Slowly ejecting the sample results in a lesser likelihood that the sample will break apart.

19. Successful powder compaction will likely result in samples looking like those in Figure 10. Thickness of the sample will vary with volume of inserted powder, but sample diameter will remain unchanged.
Load Cell Preparation

The press operator must setup an appropriate load cell readout for accurate and verifiable force/pressure results during powder compaction. The following procedures provide one method for obtaining these readouts.

1. For this procedure the user will need a Techtronic’s Tekscope (Figure 1), a DC generator (Figure 2), and the appropriate connecting leads (Figure 3).

2. Turn the Tekscope on using the button labeled 1 in Figure 1. Then set the meter to “meter mode” using button 2 and insure the meter is reading DC power by pressing button 3. Adjust the range the meter displays by pressing up or down on the buttons labeled 4. Set the range to 40V. The current range will appear on the display shown in Figure 5.

3. Connect leads between the Tekscope and the DC generator. Connect the black com port on the right edge of the DC generator to the black com port on the right side of the Tekscope. Similarly connect the remaining to red ports to one another.

4. Now adjust the knob on the DC generator to adjust the output voltage. Do not exceed 18 volts. We suggest 10 volts for easy unit conversions later. The Tekscope will accurately read the output voltage (try to be within 0.02 volts of your target value).

5. With your output voltage set, reconnect the leads to the load cell (Figure 4) output wires as shown in Figure 3. Connect the Tekscope’s red port to the green wire, the Tekscope’s black com port to the white wire, the DC generator’s red port to the red wire, and the DC generator’s black com port to the load cell’s black wire.

6. Change the range of the Tekscope to 400mV as shown in Figure 5. Use button 4 to adjust range.