

Post delivery of every jet pump and prior to any start up, a full inspection of the electrical system will be performed by qualified and licensed personnel to determine there is no wear or issues with the wiring on the unit.

Prior to any start up of any jet pump, properly trained personnel from the jet pump provider will be on site along with properly trained SandRidge personnel for visual inspection of the hook up of the unit. Same personnel will perform an effective SSAT and PSSR of the unit prior to proceeding to the start up procedure as follows.

Start Up Procedure- Water Injection/Jet Pump Unit (JPU) for Sandridge Jackson County Colorado

1. Switch on facility power supply or start generator according to manufacturer's operating procedure.
2. Switch the main disconnect on the JPU drive panel to the "ON" position.
3. Open the following valves at the well head (refer to figures in Operating Procedure Appendix).
 - a. Open V102, Tubing V104 and Casing V105 and V106 (if equipped)
 - i. (Use the choke to open the casing slowly to avoid washing out the casing valve).
 - b. V103, V107, and V108 (if equipped) will remain closed for production (down the tubing, up the casing).

If using a power fluid pressure vessel, continue to step 4. If not, skip to step 5.

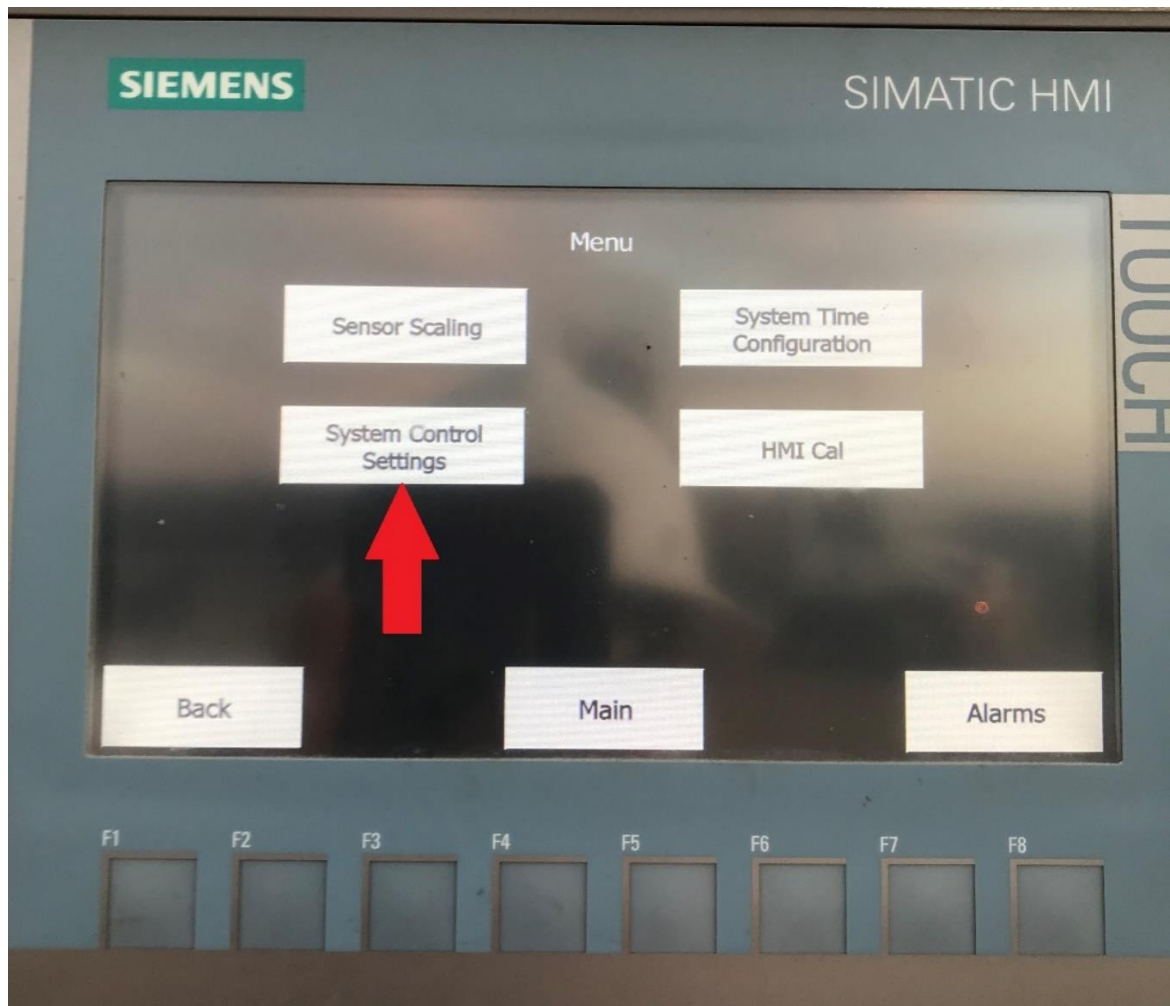
4. If equipped with pressure vessel for power fluid supply (refer to figures in Operating Procedure Appendix).
 - a. **To Operate on Power Oil- Vessel will seek level at syphon height and water will dump through V111. Oil will dump through V112**
 - i. Open V112 Surface Pump Suction Supply Outlet
 - ii. Open V109 Vessel Inlet from Casing Outlet
 - iii. Open V110 Vessel Top Syphon Outlet
 - iv. Open V111 Vessel Bottom Syphon Outlet
 - v. Open DV100 Vessel Dump Valve Outlet (Adjust to maintain enough pressure on the vessel so it is approximately 10-15 psi higher than the flow line pressure to the treater).
 - b. **To Operate on Power Water- Vessel will fluid pack and force all excess fluid/gas through V110. Water will dump through V112**
 - i. Open V112 Surface Pump Suction Supply Outlet
 - ii. Open V109 Vessel Inlet from Casing Outlet
 - iii. Open V110 Vessel Top Syphon Outlet
 - iv. Close V111 Vessel Bottom Syphon Outlet
 - v. Open DV100 Vessel Dump Valve Outlet (Adjust to maintain enough pressure on the vessel so it is approximately 10-15 psi higher than the flow line pressure to the treater).

Continue to step 6.

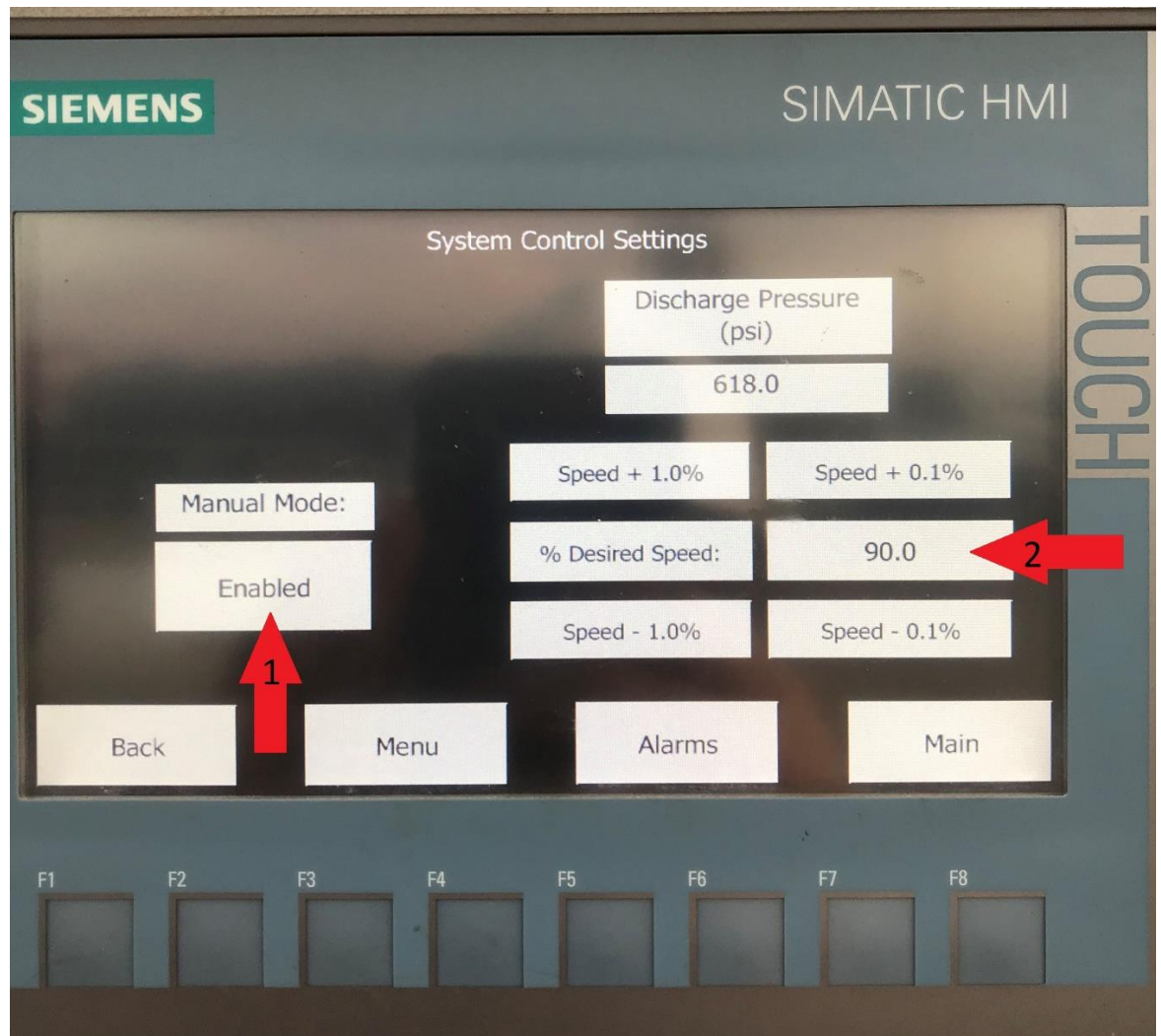
5. If equipped with a charge pump system for power fluid supply (refer to figures in Operating Procedure Appendix).
 - a. Open supply valve on facility power fluid supply tank feeding the charge pump inlet
 - b. Open the charge pump outlet valve
6. Open the following valves on the JPU (refer to figures in Operating Procedure Appendix).
 - a. Open V100 Suction
 - i. Open bleeder valve on discharge line to purge air in the system until constant fluid flow is obtained
 - b. Open V101 Discharge
7. Set both low suction and low discharge gauge kills to zero until unit is operating and pumping fluid.
8. Set the high discharge kill approximately 500 psi above target operating pressure (determined by Jet Pump design) but never to exceed the max operating pressure for the surface pump/plunger rating.
9. Set the high suction kill approximately 20 psi over target operating pressure (determined by dump valve adjustment and flow line pressure) but never to exceed the max operating pressure of the fluid vessel.

If JPU is equipped with Siemens HMI Touch Panel continue to step 10. If not, continue to step 11.

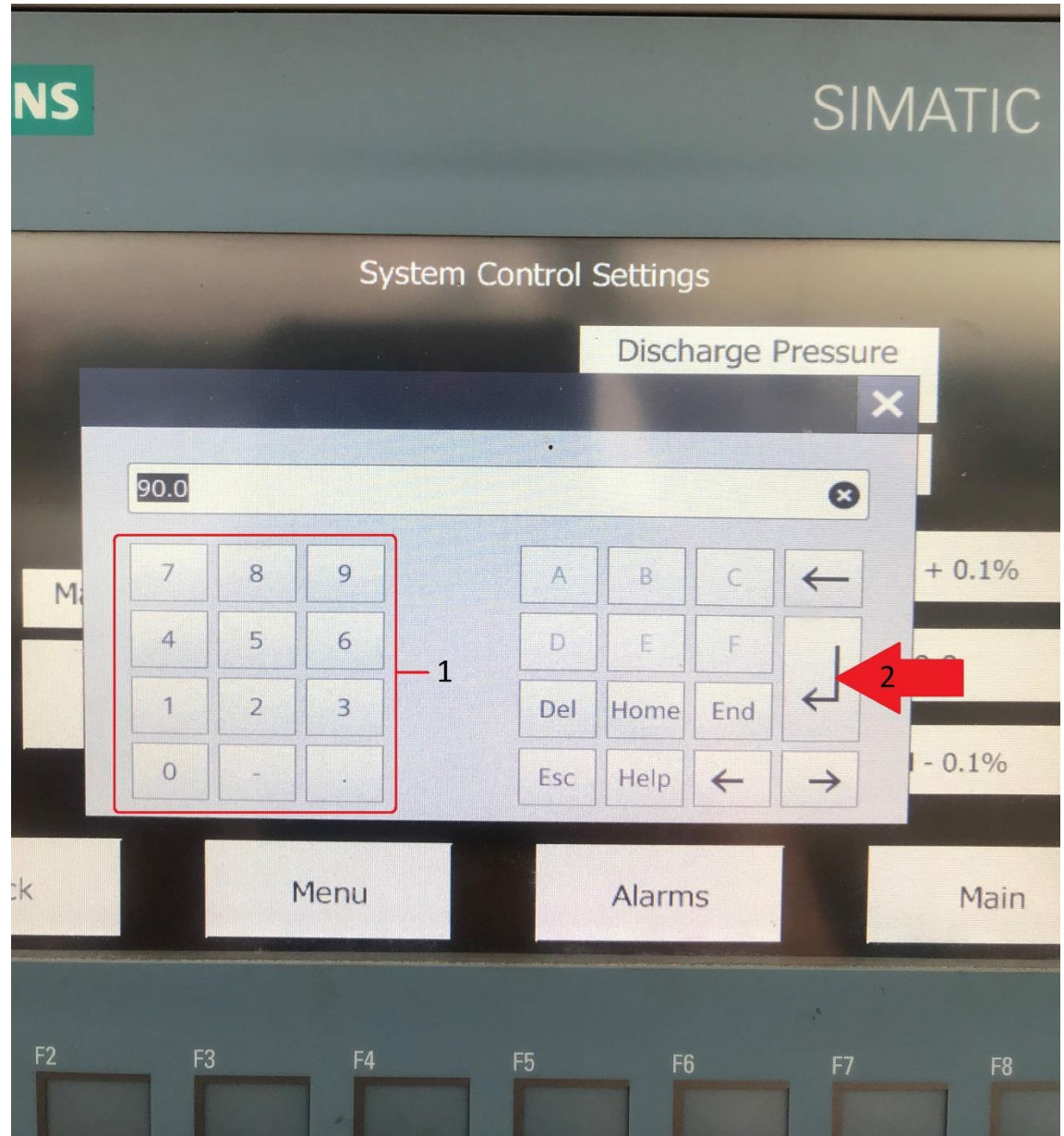
10. On the HMI touch panel (refer to figures below)
 - a. Press “Menu” then “System Control Settings”



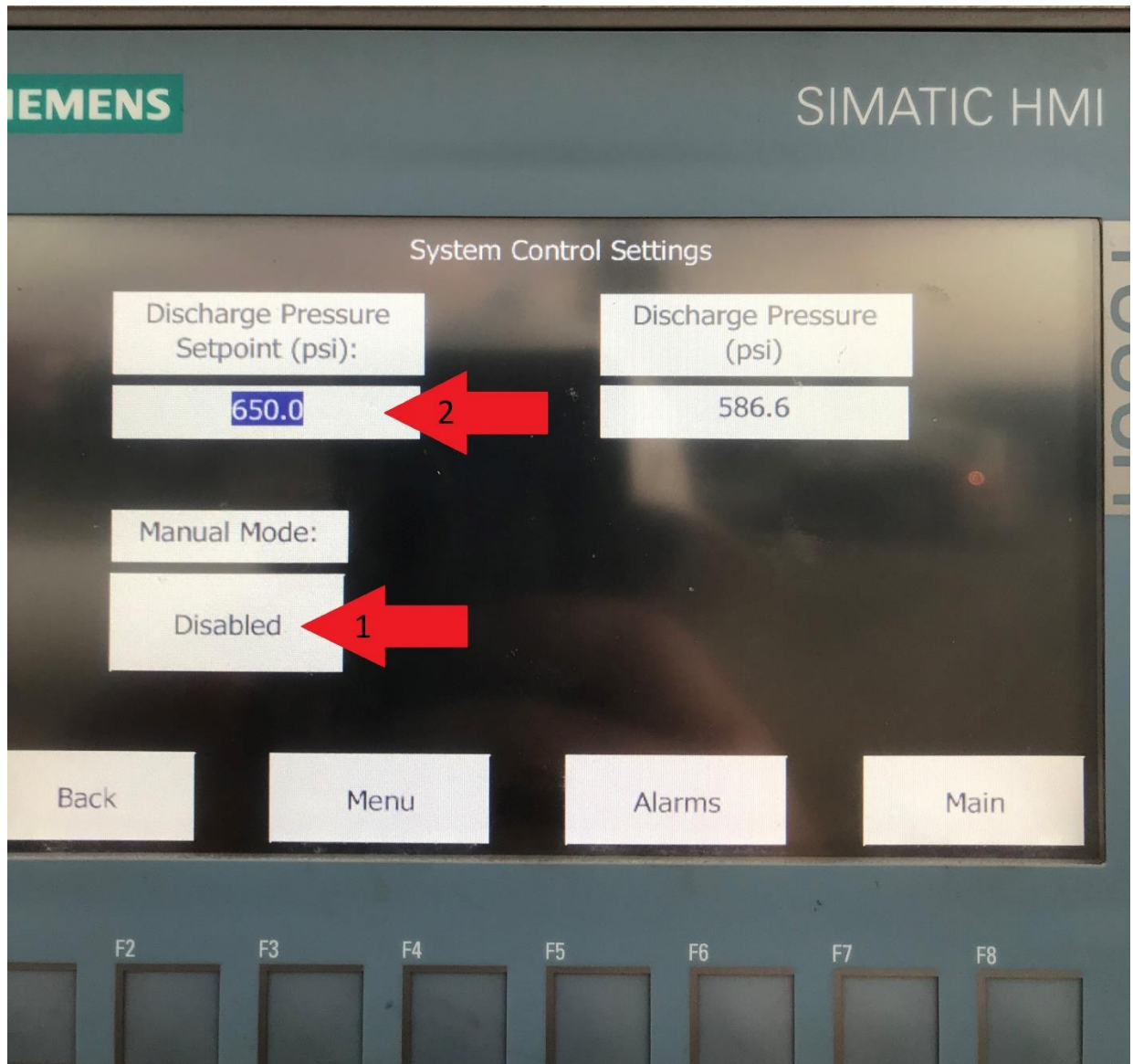
- b. To operate by maintaining drive percentage, ensure “Manual Mode” status is “Enabled” by pressing in the box ***(The drive will maintain the desired percentage at all times unless commanded to kill).***
 - i. Press the numerical box next to “Desired Percentage”



- ii. Enter the desired operating drive percentage and press enter

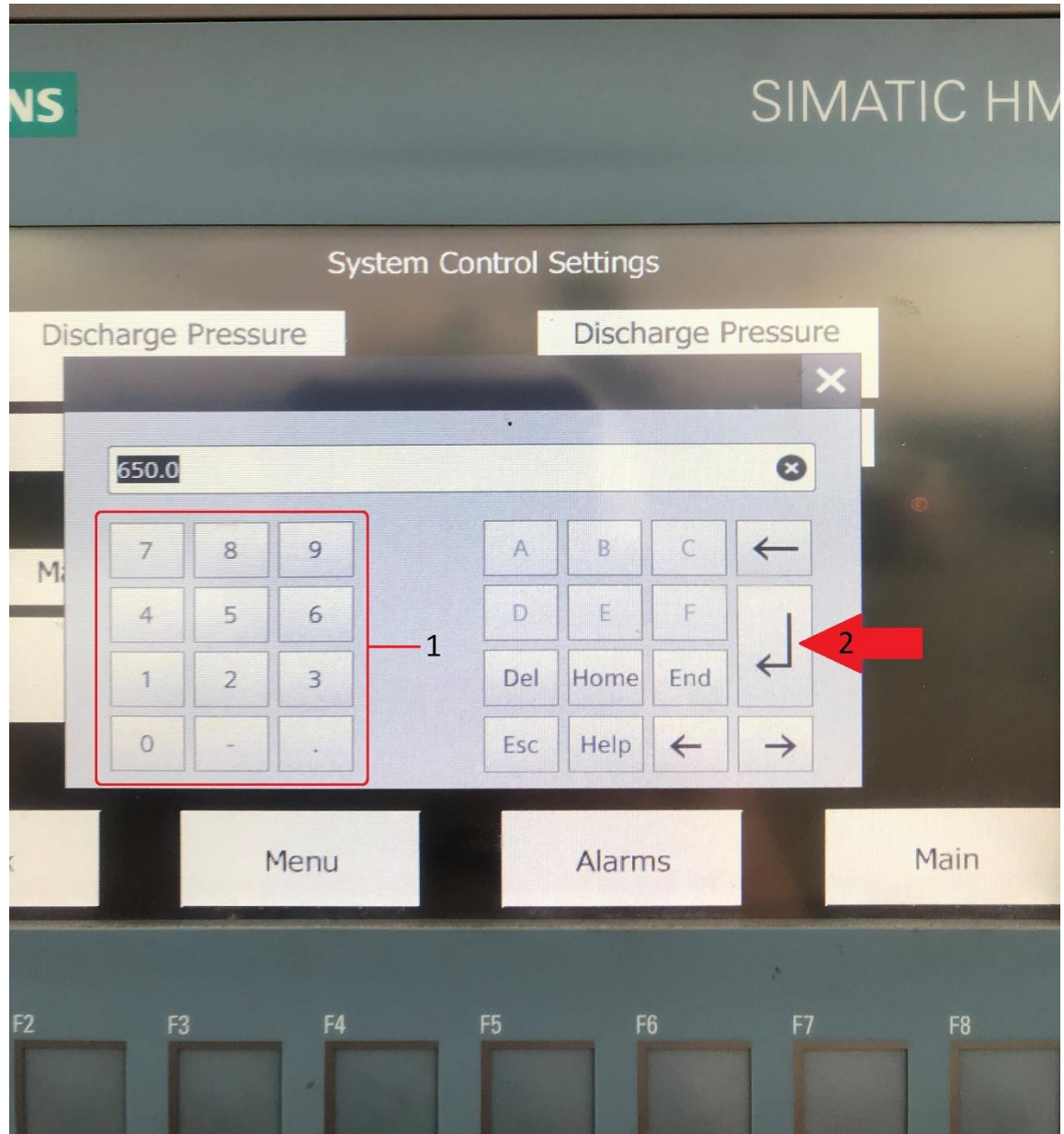


- c. To operate by maintaining a desired discharge pressure, ensure the “Manual Mode” status is “Disabled” by pressing in the box **(The drive will increase and decrease RPM as needed to maintain the set discharge pressure).**



- i. Press the numerical box next to “Discharge Pressure Set Point (PSI)”

- ii. Enter the desired operating discharge pressure and press enter



11. Verify "EMERGENCY STOP" button is not engaged. Pull out to disengage.



12. Push the "START/RESET" button on the drive panel. All tattletale light should illuminate while button is pushed and turn off when button is released.
13. If the unit is equipped with a charge pump, turn the "CHARGE PUMP" switch on the drive panel to the "ON" position (right).
 - a. Allow the charge pump to operate for 10-15 second before continuing.
14. Turn "HAND/OFF/AUTO" switch to the "AUTO" position (right).
15. Once the suction pressure raises above 20 psi on the Murphy gauge, raise the low suction kill to 20 psi.
16. Once the discharge pressure raises above 1000 psi on the Murphy gauge, set the low discharge kill to 1000 psi
17. Walk all lines and verify there are no leaks.

Shutdown Procedure

1. Turn the "HAND/OFF/AUTO" switch to the "OFF" position (center) or press the "EMERGENCY STOP" button.
2. Close V101 on the Jet Pump Unit discharge outlet.
3. Close V100 on the Jet Pump unit suction inlet.
4. Close valves at the wellhead if needed.
5. If unit is shut down as a result of an emergency.
 - a. Ensure all personnel get to the muster point identified on the Job Safety Analysis.
 - b. Call 911 or local emergency number if necessary for medical assistance.
 - c. Follow company/client protocol for reporting the incident.

IF THE UNIT WILL BE SHUT DOWN LONG ENOUGH TO FREEZE THE PUMPING FLUID WITH CURRENT TEMPERATURES, BLEED/DRAIN THE FLUID FROM THE SURFACE PUMP AND ALL LINES. ACTIVATE THE FLOAT ON THE SUMP TO DRAIN FLUID IN THE SUMP. IT IS ALSO BEST PRACTICE TO REMOVE THE VALVE COMPONENTS FROM THE FLUID END OF THE SURFACE PUMP. IF THE UNIT IS A POWDER RIVER HYDRAULICS RENTAL, PLEASE CONTACT PRH.

Daily Checklist for Water Injection/Jet Pump unit (JPU)

1. Ensure rock drill oil day tank is full (use Rock Drill 100 to fill).
2. Ensure plunger lubricator pumps are functioning and dripping at the desired rate.
3. Check gear oil and fill as needed (If unit is a Powder River Hydraulics Rental, please contact PRH if unit is leaking or consuming gear oil).
4. Verify the sump is not overflowing and the sump pump is functioning properly by lifting the float.
5. Walk all lines and verify there are no leaks.

Wear items such as packing and valves are replaced as needed throughout operation. However, it is critical to the lifespan of the JPU that a 6 month preventative maintenance is completed in addition to replacing of common wear items. The 6 month preventative maintenance includes changing the gear oil, inspecting the powerend components, and replacing any wear items needing replaced.

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Troubleshooting

1. The choke on the casing is to control gas. If excess gas is present and pushing fluid out of the pressure vessel or overrunning the treater, close the choke in small increments and monitor. Adjust as needed. We recommend the least amount of back pressure on the casing as possible for optimal fluid lifting ability.
2. If the needles on the Murphy pressure gauges are bouncing, turn the black 3" dampener valve knob in until the needles calm down. Turn the knob back out approximately 1/4 turn to ensure the dampener valve isn't completely closed.
3. If there is excess vibration in the fluid lines, slow the pump down.
 - a. Ensure there is adequate suction supply fluid to the surface pump
 - b. If not in use, a power fluid pressure vessel or charge pump may be necessary
4. If the plunger packing begins to leak, a drip is OKAY
 - a. If it begins to spray, tighten the stuffing box nuts approximately 1/4 turn at a time and allow it to reseal.
 - b. If spray continues and there is no more adjustment in the stuffing box nut, the packing will need to be replaced.
 - c. **DO NOT COMPLETELY TIGHTEN THE STUFFING BOX NUTS RIGHT AWAY!** Doing so will cause premature failure of the packing. The packing arrangement is spring loaded to keep tension on the packing at all times.
5. If you are unable to achieve or maintain the desired operating pressure there are several possible causes; below are the most common.
 - a. Poor suction fluid supply
 - b. Worn valves in surface pump fluid end.
 - i. You may hear a louder than usual knocking and/or possibly a washing sound at the fluid end as the pump strokes.
 - ii. Often times a valve or fluid knock is misinterpreted as a powerend bearing/crank knock. Sound carries through the pump. Always check the fluid supply and valves before moving onto checking the powerend.
 - c. Downhole pump throat/nozzle beginning to cavitate or simply needing resized for current well conditions.