

Design of Machine Controls

Design the machine controls for a machine that loads, then cuts, then stamp/pierces a workpiece.

Specifications and Features:

All hydraulic lines shall be steel tubing.

The machine cycle is initiated with a pushbutton, but only if all four (N, E, S, & W) machine guards are closed, as detected by limit switches.

The machine shall have emergency stops on both sides of the loader that will halt all motion with a push of a button.

After the cycle starts, a rotary actuator tips the loader 90 degrees to allow a workpiece to fall into the part cradle. To avoid damaging of the parts, the pressure to the loader must be limited to 400 psi. After the loader has returned to the home position, the electric saw motor can be turned on to begin the cutoff operation. The saw should then be advanced into the workpiece and continue until it is through the piece. The saw should then be retracted.

The speed control on the saw drive is critical. Please provide adjustable meter-out speed control on both the advance and the retract motions.

After the saw has cleared the workpiece, the stamp/pierce can begin. This is achieved with a 4.5 inch hydraulic cylinder with a 2 inch rod. The pierce must be done with a force of 15,000 # and at a speed between 5 and 10 inches per second. Provide meter-out speed control on the advance of this stroke to achieve the correct speed. Retraction of the stamp/pierce head can be done at full speed.

The control of the heavy stamp/pierce head is of concern. While a counterbalance valve was discussed, it has been determined that the lowering of the head should be controlled with the addition of PO checks.

Ejection of the part is done with a pneumatic cylinder and can be performed as soon as the pierce returns home. This process is a simple ejection without need for substantial controls.

Once started machine should continue through a single cycle unless interrupted by the operator.

1. Provide a complete design of the circuits involved.
2. List a basic Bill of Materials that does not need to include manufacturer and part number, but list and type of component.
3. Specify the following:
 - A. Inlet line:
 - B. Pressure lines:
 - C. Relief Valve setting:
 - D. Pump gpm:
 - E. Tank size:
 - F. Loader Pressure Reducer setting:
 - G. System horsepower: