

4.1 Control aspects

It consists of 5 main elements (PLC, Limit switches, power supply 24 v, level switch and relays 8 pins 24 v).

PLC contains the ladder program which contains all the instructions that controls the system especially at automatic mode, as well as, the relays connect between the control circuit as shows in figure (4.1) and the power circuit as shows in figure (4.2) depends on the signals that are send from the control circuit.

The power supply (24 v) that provides the controlling system by suitable power after step it down from 220 v to 24 v.

The main controlling part has two kind of switches (limit & level), the system has two limit switches one of them on idle point and the other one is on the running point which controls the electrical motor (stopping, running), and the level switch has an important role because it stops the centrifugal pump when the drum is fully discharged.

The screw shaft is connected with electric motor -which has bidirectional rotation- vertically by direct coupling, And the portable plate which holds the pumps is fitted with the ball screw that moves the pumps up and down depend on the electric motor rotation (forward, reverse).

The system has two centrifugal pumps one of them on the duty and another one as a standby, the running chance is switching between the two pumps as the operation and maintenance circumstances.

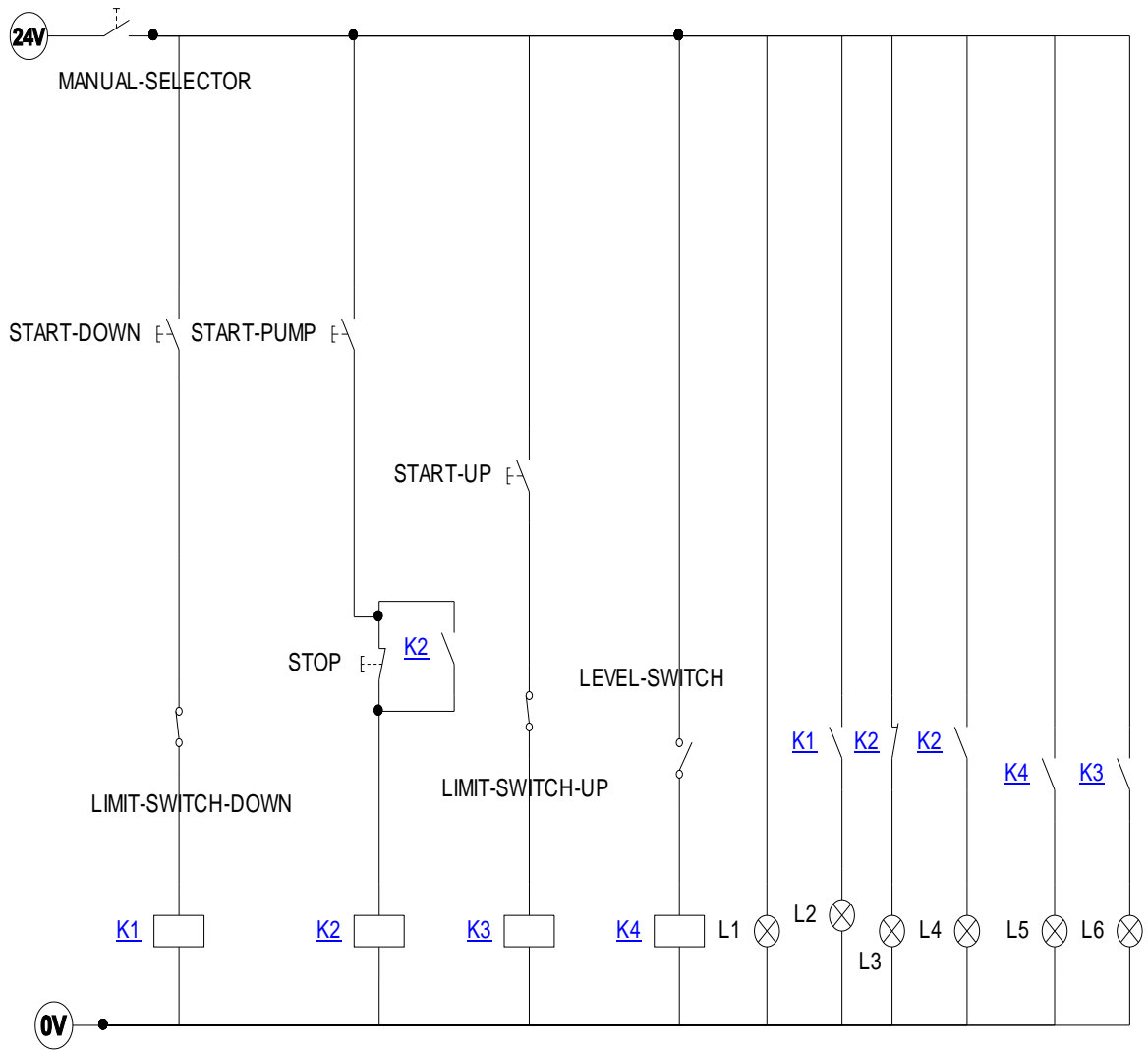


Figure (4.1): Control circuit diagram

The two limit switches (up, down) is connected with control circuit as shows in figure (4.1) to connect and disconnect the power from the electrical motor when the lift reaches to certain point.

The control circuit is connected also with level switch that passes the power to the pump when the drum has amount of liquid and open the circuit when the drum is empty. So we can say that the limit switches and the level switch are a protection and controlling devices.

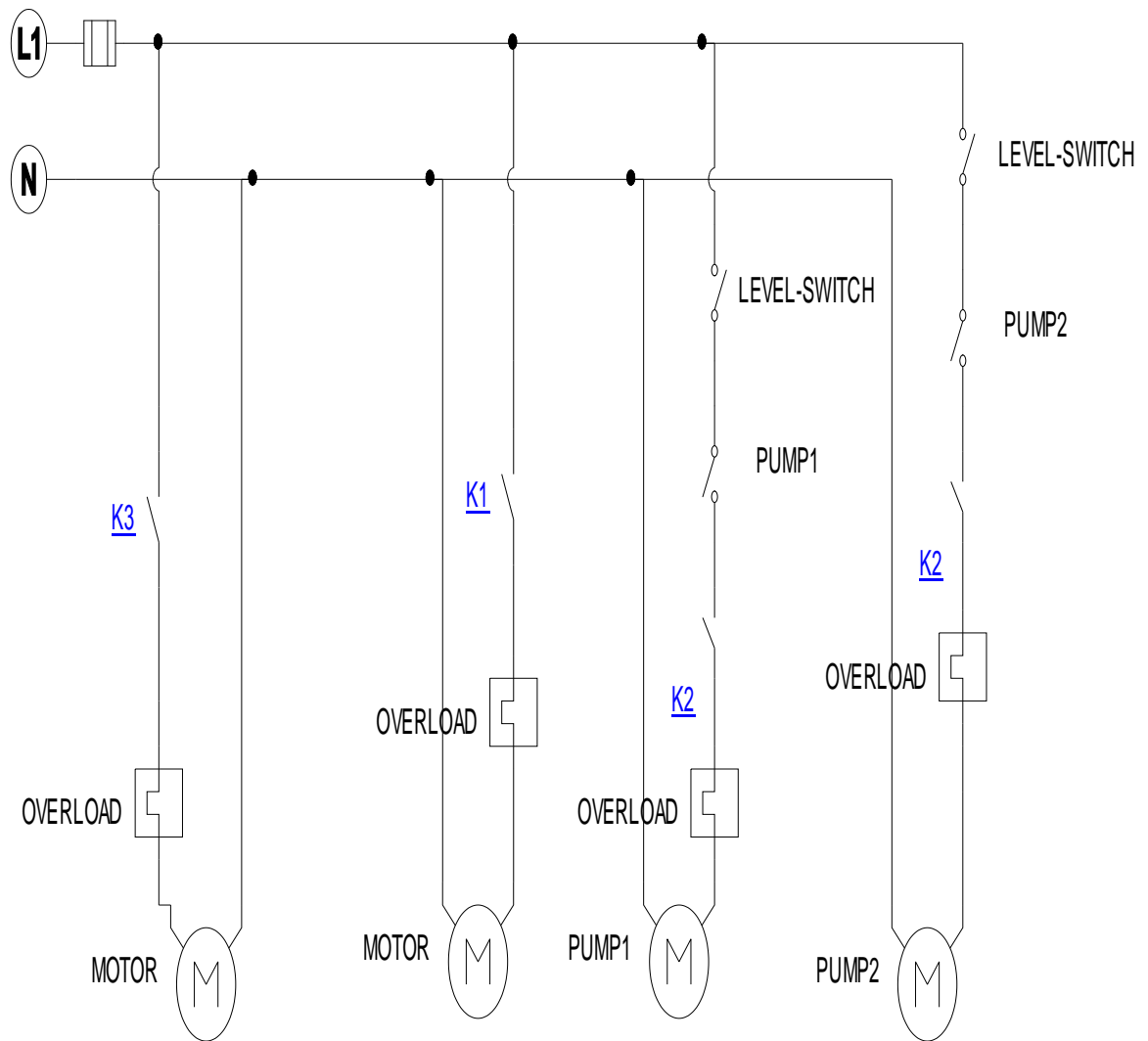


Figure (4.2): Power circuit diagram

The control panel as shows in figure (4.3) contains 6 relays (8 pins, 24 v) that connect and disconnect the power to the main parts at receiving and missing the controlling signals.

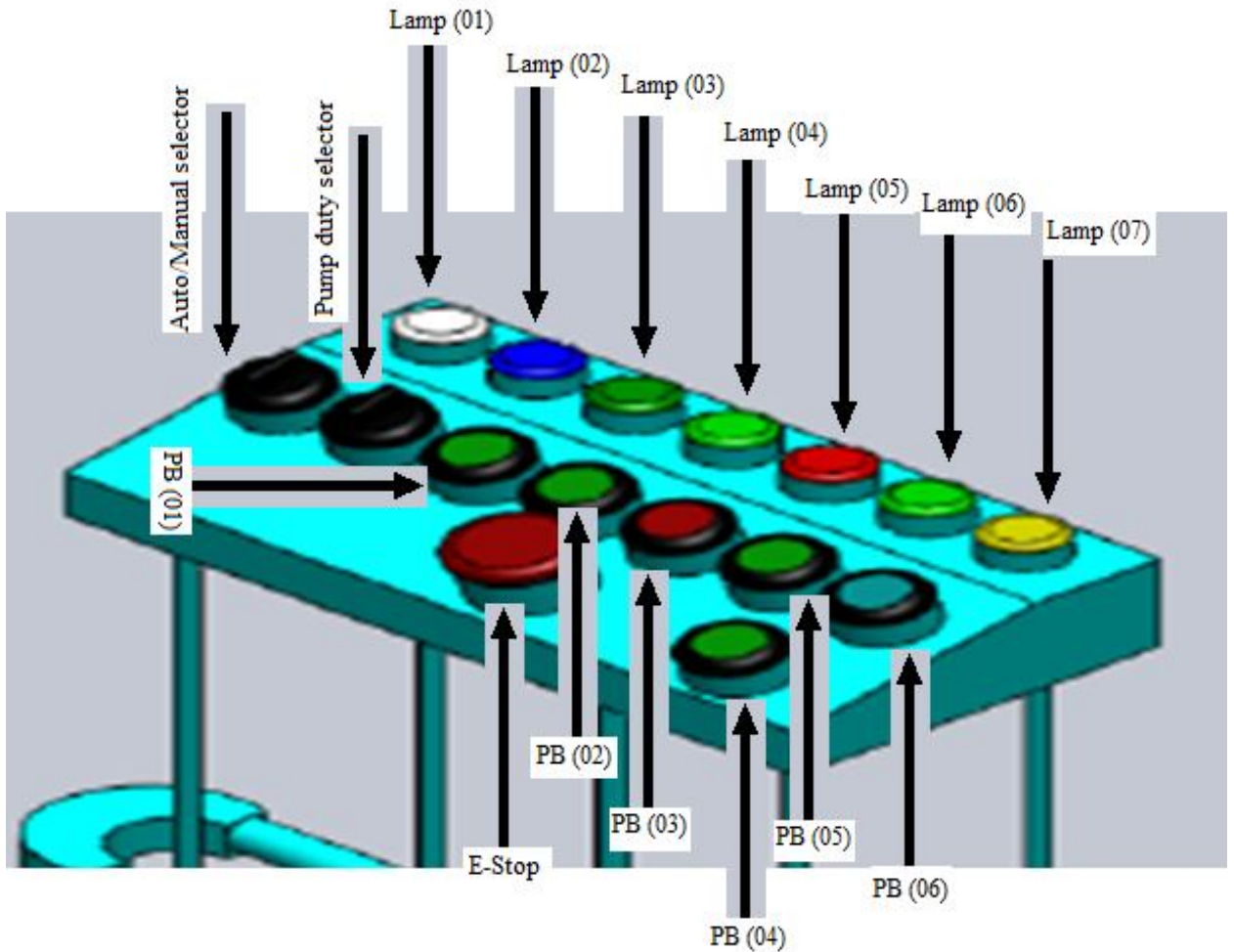


Figure (4.3): System control panel

Relay (01) uses to run and stop the discharging pumps.

Relay (02) uses to run and stop the electrical motor at forward direction.

Relay (03) uses to run and stop the electrical motor at reverse direction.

Relay (04) make a connection between the level switch and the PLC input module.

Relay (05), relay (06) use to isolate all the manual mode when the selector on auto mode to avoid any interference.

The control panel as shows in figure (4.3) contains two selectors, the first selector is used to determine which pump in duty and which pump in standby. The second selector is used to determine the operation mode (manual mode or auto mode).

The emergency stop is a main part in the control panel which is used to isolate the power from the control circuit as shows in figure (4.3) at emergency circumstances.

As well as the control panel has 7 indicator lamps which reflect the process condition as follow:

Lamp (01): white lamp turns on when the power is connected with the system.

Lamp (02): blue lamp connects to the level switch, turns on when the switch touches the liquid surface.

Lamp (03): red lamp turns on when the pump stopping period.

Lamp (04): green lamp turns on when the pump running period.

Lamp (05): green lamp turns on at the lifting up period.

Lamp (06): green lamp turns on at the lifting down period.

Lamp (07): yellow lamp turns on at failure condition (just at auto mode).

The control panel contains also 6 push buttons connected to the control circuit to facilitate the controlling on the system as follow:

PB (01): normal open push button is used to run the pump just at manual mode.

PB (02): normal close push button is used to turn of the pump just at manual mode.

PB (03): normal open push button is used to lift the pump down just at manual mode.

PB (04): normal open push button is used to lift the pump up just at manual mode.

PB (05): normal open push button is used to reset the system just at auto mode.

PB (06): normal open push button is used to start the system just at auto mode.

The lubrication and greasing of the system mechanical elements (ball screw, lead screw and bearing) is so important to avoid wearing and cracking defects which happens due to high friction between the different elements.

The system contains of 4 wheels with breaker to facilitate the system transportation when need to do that.

Finally the system performs in good conditions and work well, easily and safely.