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Implementation of PLC Control Panel for Valve Hole Piercing 100 Ton Hydraulic Press

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ABSTRACT: The project is produced to manufacturing the 100 ton forced valve hole piercing hydraulic press. The press is setup fully automatically to forming a accurate size and shape by using PLC. It is have two control panel. One is main control panel another one is pendent control panel. The main control panel having the components are, PLC along with MCCB, MCB, MPCB, Coil Relay, Transformer, Preventer(single phase), Contactor and HMI (Human Machine Interface). Here using PLC is SIEMENS company'sS71500IPN SIMENTIC. The pendent control panel having a push buttons, indicators lights and HMI (Human Machine Interface). Where the components are usually performing a sequence of operation. This machine is used to piercing operation in vehicle rim. The press working in smoothly and rapid functioning with help of hydraulic system. This type of machines is mostly preferred for risk free manufacturing environment and minimum cost of overall production.

I. INTRODUCTION

The industry has run with machines of metal forming operation in which are invented by man for increase the production and reducing his time of work, in which the shape of hole is formed from sheet metal. In starting point, the controlling process is done by the isolator which trips the circuit totally when the fault occurs in the machine. Then the machine going to be manual operation up to machine reached in normal condition. PLC is used to identify the fault easily and it is easily modified for required logic. Here the low power consumption and high operating frequency and also faster operation. All switches, sensors, valves, relays are displayed in ladder logic. The problem is the induction motor cannot be stopped instantly and it consumes more power when compare to servo motor and also it has low starting torque. The servo motor is assembled for four parts; they are normal dc motor, positioning sensing unit, gear reduction unit, control circuit unit. Here usage of relay is high because of more protective. It is increase the cost and more maintenance of machine. The machine is full and fully automatic with help of PLC module. It is placed in a main control panel. The control panel includes various components such as MCCB, MPCB, MCP, Relay, SMPS, Power supply, Single phase preventer. Here HMI is used to display the current position of the machine.

II. MAIN COMPONENTS

Power supply

Power supply is the electrical device that supplies the power to the electrical load. The function of the power supply is use to convert the electric current from a source to correct voltage, current and frequency to the power load. And other function is to limit the current drawn by the load to safe zone. The power supply is come from electric grid and energy storage device and solar energy converter.

SMPS

SMPS is stands for Switched Mode Power Supply. It is used to switching regulator to convert electric power efficiently.

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TRANSFORMER

It is a static electrical device that transfer electrical energy from one or more circuits without changing frequency. It is works on the basic principle of faradays law of magnetic induction. Today they are designed to use AC supply, which means that fluctuation in supply voltage is impacted by the fluctuation in the current. It is the device that convert the alternating current (AC) current of certain voltage to different voltage without changing the frequency. The transformer is further classified into two types. One is 'step up' transformer another one is 'step down' transformer. The step up transformers which convert the low voltage into high voltage and step down transformer is convert high voltage into low voltage.

HMI (Human Machine Interface)

Human Machine Interface (HMI) is used to display the current position of the machine. Human Machine Interface technology has been used in different industries like electronics, entertainment, military, medical, etc. The interface consist of both hardware and software. Human Machine Interface is also called as the Man Machine Interface (MMI).

CONTACTOR

A contactor is a electrically controlled power circuit. The contactor is controlled by the circuit, which has a much lower power level than the switched circuit, such as a 24-volt coil electromagnet controlling a 230-volt motor switch. Contactors are directly connected to the high current load.

Contactors are used to control the electric motors, lighting, heating, capacitor, banks, thermal evaporators, and other electrical loads.

RELAY

Relay is one of the most important electromechanical devices highly used in industrial applications. A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operated a switch, but other operating principles are also used, such as solid- state relays. Relays are use where it is necessary to control a circuit by a separate low- power signal, or where several circuits must be controlled by one signal. A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid- state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching.

MCB

Miniature Circuit Breakers are electromechanical devices which protect an electrical circuit from an over current. The over current, in an electrical circuit, may result from short circuit, overload or faulty design. An MCB is a better alternative to a Fuse since it does not require replacement once an overload is detected. Unlike fuse, an MCB can be easily reset and thus offers improved operational safety and greater convenience without incurring large operating cost

INDUCTION MOTOR THEORY

An induction motor or asynchronous motor is an AC electric motor in which the electric current in the rotor needed to produce torque is obtained by electromagnetic induction from the magnetic field of the stator winding.[1] An induction motor can therefore be made without electrical connections to the rotor.[a] An induction motor's rotor can be either wound type or squirrel-cage type.

Three-phase squirrel-cage induction motors are widely used as industrial drives because they are self-starting, reliable and economical. Single-phase induction motors are used extensively for smaller loads, such as household appliances like fans. Although traditionally used in fixed-speed service, induction motors are increasingly being used with variable-frequency drives (VFDs) in variable-speed service. VFDs offer especially important energy savings opportunities for existing and prospective induction motors in variable-torque centrifugal fan, pump and compressor load applications. Squirrel cage induction motors are very widely used in both fixed-speed and variable-frequency drive (VFD) applications.

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The stator of an induction motor consist of a number of overlapping winding offset electrical angle. This data at which input frequency is 50 HZ more than one frequency is marked on the name plate. A normally full-load speed RPM is 1441.Efficiency in percentage 10%

PLC (Programmable Logic Control)

A programmable logic controller (PLC) or programmable controller is an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices, or any activity that requires high reliability control and ease of programming and process fault diagnosis.

PLCs were first developed in the automobile manufacturing industry to provide flexible, ruggedized and easily programmable controllers to replace hard-wired relays, timers and sequencers. Since then, they have been widely adopted as high-reliability automation controllers suitable for harsh environments. A PLC is an example of a "hard" real-time system since output results must be produced in response to input conditions within a limited time, otherwise unintended operation will result.

Control panel

The use of control panel is based to solve automation problems is essential to manufacturing automation today. This work describe the design and implementation of control system for the operation of a mechatronic hydraulic press

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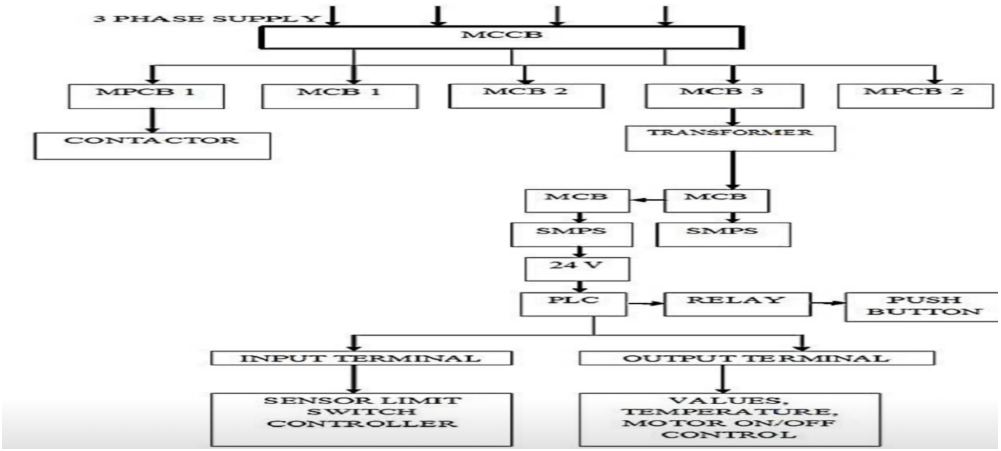
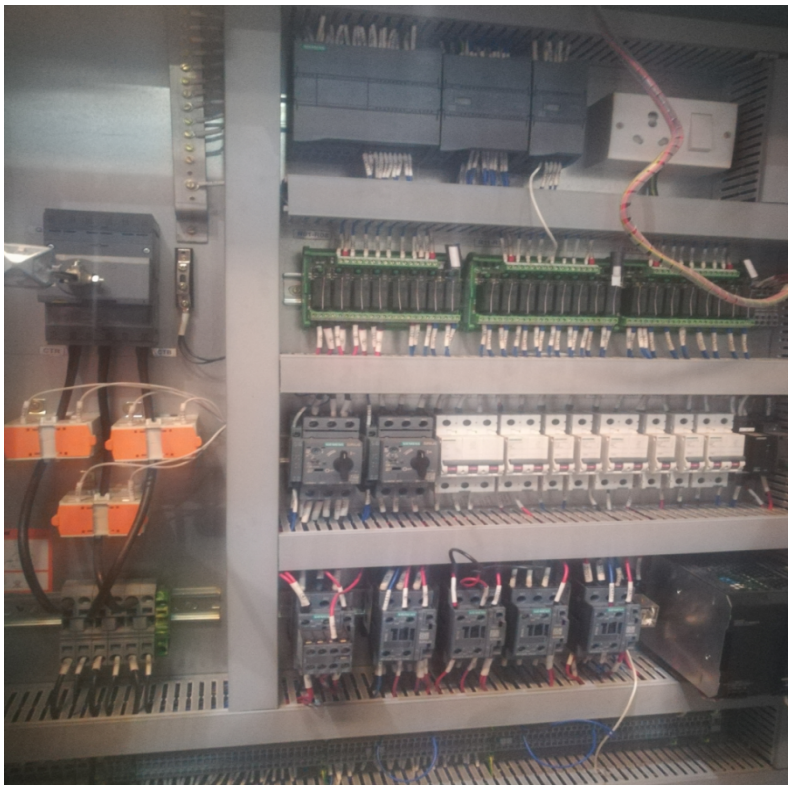
machine. The overall operation and control is based on a programmable logic unit(PLC)and a sensory system . The functionality of the control system is analysed through qualitative simulation models, and validated with physical experiments prior to the implantation. The overall control design and operation produces applied have enabled the reduction of sensor failures and machine malfuntioing

Block diagram of control panel



Control Panel



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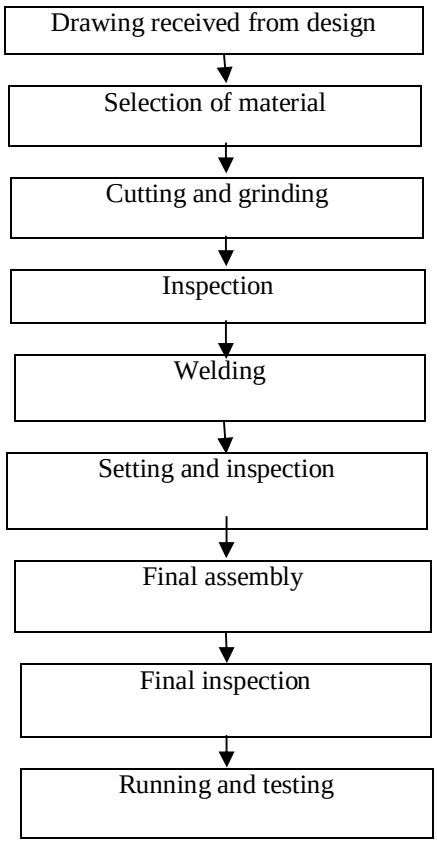
LVDT

The LVDT alters a linear dislocation from a mechanical position into a relative electrical signal including phase and amplitude of the information of direction and distance. The operation of LVDT does not need an electrical bond between the touching parts and coil, but as an alternative depends on the electromagnetic coupling. The LVDT full form is "Linear Variable Differential Transformer" is LVDT. Generally, LVDT is a normal type of transducer. The main function of this is to convert the rectangular movement of an object to the equivalent electrical signal. LVDT is used to calculate displacement and works on the transformer principle. The applications of LVDTs mainly include automation, power turbines, aircraft, hydraulics, nuclear reactors, satellites, and many more. These types of transducers contain low physical phenomena and outstanding repetition. Because the machine depends on the combination of magnetic flux, this transducer can have an unlimited resolution. So the minimum fraction of progress can be noticed by an appropriate signal conditioning tool, and the transducer's resolution is exclusively determined by the declaration of the DAS (data acquisition system).

III. FLOW CHART



IV. CONCLUSION

Thus in all the industries the product manufacturing operation is done by manual which cause the accident due to his lack of concentration. To overcome this machines are introduced to perform the operation automatically. Here the machines are monitor by the way of PLC program. The PLC operation involves the operation with SCADA which is very easy to operate from the PC itself. Thus the operating time is get reduced with high production and saving of

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electricity up to 30% by using servo motor in the place of induction motor. The wiring complexity is reduced by connecting the relay. PLC program was designed for controlling the machine either automatic or manual. It is undergone to stress relief process. Designed frame is under gone to the floor boring section. After floor boring it is taken for the painting and assembled in the assemble section. The final inspection is performed in the assembly and production is checked according to the load arrangement. The machine is dismantled for repainting and ready for dispatch.

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