Summer Internship

At

Honda Siel Power Products Ltd.

Project Report

Under the Supervision of

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- **Project Assigned:** Equipment and Machine Safety Assessment

Acknowledgements

I would sincerely like to thank Mr. C.B Singh(AGM), Mr. N.P.S Rana (AGM) and Mr. Atul Rastogi (Manager) for providing me with an opportunity to work at the Maintenance & Utilities Department at Honda Siel Power Products Ltd. I would like to thank Mr. Abid Ali (S.E) without who's help this project would not have been a success. I would also like to thank Ms. Jagriti Dubey(Eng.) for her constant guidance and support throughout this project. I would also like to extend a thank you to Mr. Ashok David (A.E), Mr. Deepak and Ms. Kamini who were constantly involved in my training. I would also like to thank Ms. Sonal Raghuvanshi (H.R) for her active involvement in the internship program.

Abstract

The project aims at learning about the activities performed by Maintenance & Utility department at Honda Siel Power Products Ltd. The project assigned involves learning about machines and equipment present in premises and the procedures to reduce downtime on machines by performing Preventive maintenance and Breakdown maintenance also, it concentrates on importance of machine safety.

Preventive or scheduled maintenance(PMI) refers to the maintenance where equipment or facilities are inspected, maintained and protected before break down or other problems occur. Corrective or Breakdown maintenance refers to the maintenance where equipment is repaired or replaced after wear, malfunction or break down. These will be discussed in detail.

This project will discuss about the control of machines that broadly involves usage of Programmable Logic Control (PLC) and Computer Numeric Control (CNC).

The project will focus on different safety devices as well as safety measures and modification in logic of PLC.

Contents

About Honda……1

Maintenance Department Layout……2

Introduction……3

Maintenance and Utilities Department……3

Maintenance and it's types……3

Safety……4

Different Types of Safety Measures in Pant……5

Fire……5

Electrical Safety……8

Safety against Human Mistakes……12

Online Safety Management……13

Other Safety Measures……14

Machine Circuits……17

Control Circuit……*17*

Power Circuit……*17*

PLC Ladder Circuit……18

Manual VS CNC Machines……19

PLC (Programmable Logic Controller) ……20

What is a Relay & How does it work……21

Pressure Switch and it's Working……22

Overview……24

Breakdown Project……26

Conclusion……34

About Honda

India's No. 1 Power Products company, Honda Siel Power Products Limited (HSPP), is a subsidiary of Honda Motor Co. Japan and was incorporated on 19th Sept 1985.Ever since, it has been the undisputed leader in the power products industry, manufacturing and marketing a range of Portable Generators, Water Pumps, Tillers and General-Purpose Engine at its state-of-art manufacturing facility at Greater Noida. It is also engaged in the marketing of Lawn Mower, Brush Cutter and Long-tailed outboard motors.

What started 31 years ago as a dream to serve our customers with products that truly help him do their work more efficiently has unfolded into a remarkable journey of achieving many milestones. HSPP has been the preferred choice of the customers worldwide and its existence is the result of the creation of the joy of buying, selling & empowering the dreams of over 2.5 million users which makes HSPP the undeniable leader in the power production industry.

Driven to the core by its philosophy of "The power of dreams", HSPP with the strength of 17 Area Offices across India and over 600 dealers have been continuously bringing joy and satisfaction through its range of power products that suit the requirements of a variety of customers segments in agriculture, domestic and commercial. This gives the customers the choice to demand more from the world leader "Honda".

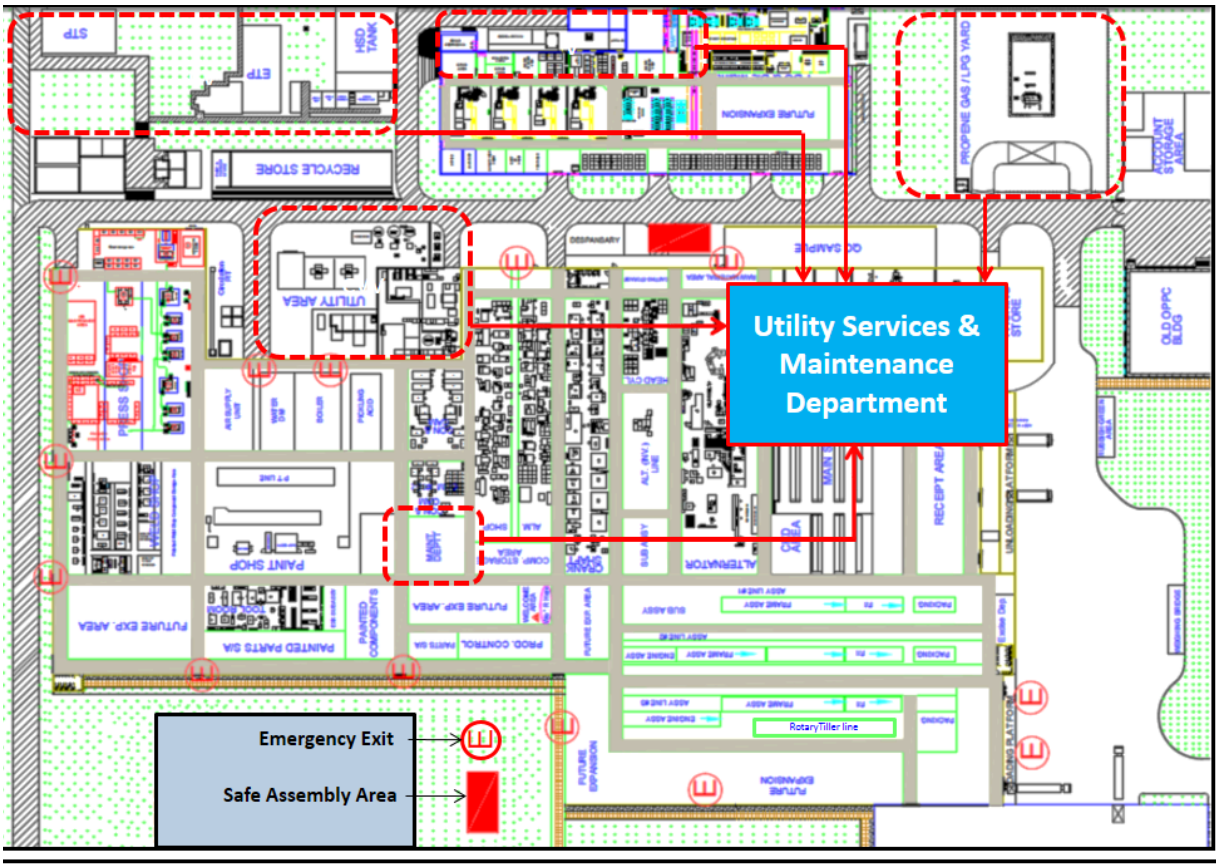
HSPP benefits from the rich experience of Honda Motor Co. Japan the second largest engine manufacturer in the world, because of their strong emphasis on R&D and in-house technical innovation. The Ultra Silent, self-start range of India's first "Pure Sine Wave EU series Generator" and the highly fuel-efficient range of OHV Engines are some of the products which exemplify Honda's pursuit of technological excellence. The product range of Generators conforms to the most stringent phase ll Noise & Emission norms as laid down by Central Pollution Control Board (CPCB), Government of India.

Every product manufactured is the result of persistence in quality, giving it the cutting edge for that extra reliability. It was in recognition of this that HSPP became the first power products manufacturing company in India to have been awarded the ISO 9001:2000 Certification for its Quality Assurance Systems & ISO 14001 for its Environment Management systems.

Honda is committed to bringing joy in the lives of customers through innovative, reliable and technologically advanced power products that make a significant contribution to the Indian society by increasing the quality of their living standards and becoming a part of their daily lives.

While maintaining its leadership in the domestic generator market and export to over 35 countries, HSPP is making active efforts in developing new applications for its General-Purpose Engines (GPE). HSPP enjoys the majority of market share of Generators and Water pumps. The business of GPE and Water Pump sets is expected to contribute significantly to the company's future growth plan

Maintenance and Utilities Department Layout



Introduction

Maintenance & Utility Department

- Maintenance department is responsible for breakdown maintenance and preventive maintenance of complete plant machinery along with the operation and maintenance of utilities for ensuring achievement of production target as per business plan at an optimum cost.
- The department is also responsible for the implementation of safety environment management system as per the requirement of ISO 14001 and HSPP safety policy.
- Identification and compliance of all strategic requirements related to environment and safety are also among the major roles that this department perform.
- Overhauling of m/c for restoring the reliability and geometric accuracies as per manufacturer standards is a must.
- Installation and commission of new projects related to the plant expansion, new processes, new machines, new buildings, etc. are carried out effectively.
- Spare parts planning and procurement is also done to ensure smooth working of the machines.
- Conducting monthly safety patrolling with safety committee and also conducting safety training are some other major tasks which this department takes up.

Maintenance of and its types-

Maintenance refers to the process of preserving a condition or situation or the state of being preserved.

The basic types of maintenance include:

- Preventive or scheduled maintenance, where equipment or facilities are inspected, maintained and protected before break down or other problems occur.

- Corrective or breakdown maintenance where equipment is repaired or replaced after wear, malfunction or break down.

Safety

Safety is an integral part of an industry. It not only prevents the loss of working man hours, production material, plant and machinery, interruption but also provides a risk-free work environment, thereby increasing the production and efficiency. Safe working environment helps us to avoid accidents and injuries.

The main problems in the Engineering Industry are-

a) Safety of Human Beings
b) Safety of Machines, Tools and other equipment-
    - Electrical Short Circuits
    - Insulation failure or open wires
    - Lightning
    - Voltage transients
c) Safety of construction equipment, buildings including structural failure
d) Explosion due to explosive material or petroleum products.

Reasons for such problems can be-

- Lack of Knowledge
- Unmindful attitude
- Mishandling of equipment
- Sudden machine control failures
- Natural Causes (Fire, earthquakes, cyclones etc)

Important steps for Safety-

- Education and Training
- Use of safety equipment
- Display of safety measures
- Adherence to Rules and Regulations
- Termination of Unsafe Practices
- Design of Safety Measures

Different types of Safety Measures in the Plant

Fire

Classes of fire

- Class A - fires involving solid materials such as wood, paper or textiles.
- Class B - fires involving flammable liquids such as petrol, diesel or oils.
- Class C - fires involving gases.
- Class D - fires involving metals.
- Class E - fires involving live electrical apparatus. (Technically ‘Class E’ doesn’t exists however this is used for convenience here)
- Class F - fires involving cooking oils such as in deep-fat fryers.

Types of extinguishers

Water extinguishers

Water extinguishers are one of the most cost-effective ways to fight Class A fires, those fuelled by solid materials such as paper, wood and textiles.

There are four different types of water extinguishers: water jet, water spray, water with additives and water mist or fog.

- Water jet extinguishers work by spraying a jet of water at the burning materials, cooling them and preventing re-ignition. They should not be used on live electrical equipment.
- Water spray extinguishers use a very fine spray of water droplets, each droplet is surrounded by air which is non-conductive. Most water spray fire extinguishers carry a 35-kV dielectric test approval which means they have been tested on a 35,000 Volt electrical source at one meter.
- Water extinguishers with additives are water extinguishers with foaming chemicals added. The water loses its natural surface tension meaning that it can soak into the burning materials more effectively. Adding the chemicals to the water means that a smaller extinguisher can produce the same fire rating as a larger, water only, extinguisher.
- Water mist, or fog, extinguishers apply water in the form of mist, or fog, the droplets are much smaller than those from the water spray extinguisher. The smaller the droplet, the larger its surface area in relation to its size, the quicker the droplet evaporates which absorbs the heat energy faster. The downside is the smaller the droplet the less it weighs and therefore the less powerful the cloud of water.

All water extinguishers have a red label.

Foam extinguishers

Foam fire extinguishers can be used on Class A and B fires. They are most suited to extinguishing liquid fires such as petrol or diesel and are more versatile than water jet extinguishers because they can also be used on solids such as wood and paper. The foam extinguishes liquid fires by sealing the surface of the liquid, preventing flammable vapour reaching the air and starving the fire of fuel. They are not suitable for use on free flowing liquid fires.

Foam extinguishers have a cream label.

Powder extinguishers

Powder extinguishers are a good multi-purpose fire extinguisher because they can be used on Class A, B and C fires. They can also be used on fires involving electrical equipment however, they do not cool the fire so it can re-ignite. Powder extinguishers can also create a loss of visibility and may create

breathing problems. They are not generally recommended for use inside buildings unless there is absolutely no alternative.

Powder extinguishers have a blue label.

Carbon dioxide extinguishers (CO2)

CO2 extinguishers are ideal for places with a lot of electrical equipment such as offices or server rooms because they are safe to use on fires involving electrical apparatus. Carbon dioxide extinguishers do not leave any residue, unlike a foam extinguisher. They can also be used on Class B fires, those involving flammable liquids such paraffin or petrol. CO2 extinguishers work by smothering the fire and cutting off the supply of air.

Carbon Dioxide Extinguishers (CO2) have a black label.

Wet chemical extinguishers

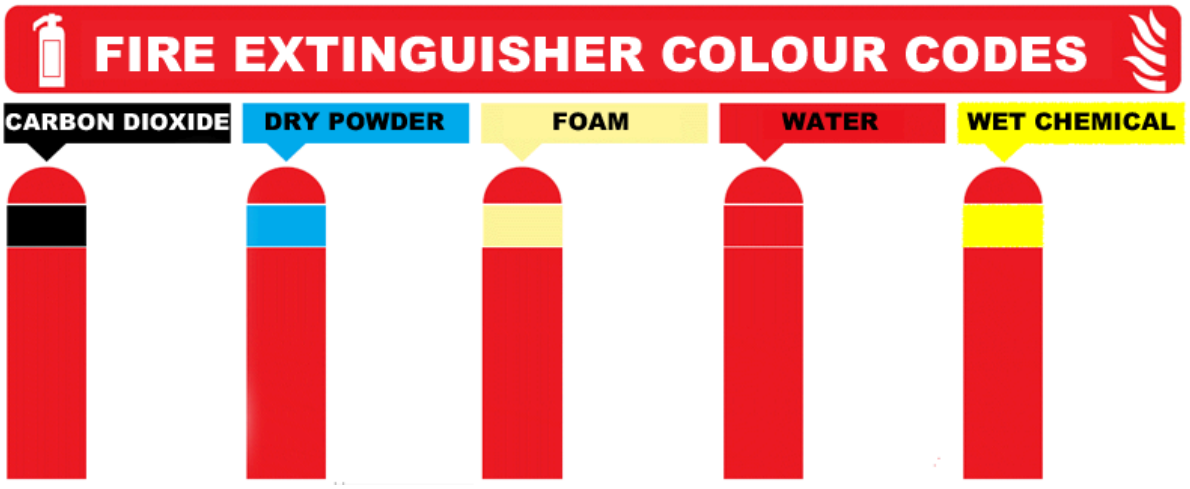
Wet chemical extinguishers are suitable for use on Class F fires involving cooking oils and fats, such as lard, olive oil, sunflower oil, maize oil and butter. They are extremely effective, when used correctly. The wet chemical rapidly knocks the flames out, cools the burning oil and chemically reacts to form a soap-like solution, sealing the surface and preventing re-ignition. Although they are primarily designed for use on Class F fires, cooking oils and deep fat fryers. They can also be used on Class A fires (wood, paper and fabrics) and Class B fires (flammable liquids).

Wet chemical extinguishers have a yellow label.

Fire Hydrant System

The fire hydrant system in the plan is excellent. A number of fire hydrant systems spread across all over the plant. Fire hydrant line colour is red and they are always charged with 5-5.5kg/cm sq. pressure. For charging the lines there are two underwater tanks of capacities 20KL and 10KL respectively. For maintaining the pressure four pumps are connected parallelly from them two pumps are jockey pumps. One is the main pump and the other one is the diesel pump. When the pressure falls down from 5kg/cm sq. to 3kg/cm sq., there is a

pressure difference of 2kg/cm sq. From 5kg/cm sq. onwards the main pump will work. These main pumps and jockey pumps are electrically operated. Only in case of emergency when electrical power supply of these motor pumps interrupt and the pressure falls down, the diesel pump will automatically start and maintain pressure of 5kg/cm sq.



Electrical Safety

Equipment Earthing

Equipment earthing is a connection done through a metal link between the body of any electrical appliance, or neutral point, as the case may be, to the deeper ground soil. The metal link is normally of MS flat, CI flat, GI wire which should be penetrated to the ground earth grid. Equipment earthing is based on IS:3043-1987 Standards.

The earthing is broadly divided as

1. System earthing (Connection between part of plant in an operating system like LV neutral of a power transformer winding) and earth.
2. Equipment earthing (safety grounding) connecting bodies of equipment (like electric motor body, transformer tank, switchgear box, operating rods of air break switches, LV breaker body, HV breaker body, feeder breaker bodies etc) to earth.

Double Earthing

Double earthing is provided for all equipment. When one earth connection is corroded or ineffective the other one will provide the connection to earth. if only one earth connection is provided and if the connection is not good then the system become ungrounded. In other words, double earth connection is used to give minimum resistance to the flow of whole current of that apparatus in case short circuit or leakage or any other such fault happens.

OLR (Over Load Relay)

Thermal overload relays are economic electromechanical protection devices for the main circuit. They offer reliable protection for motors in the event of overload or phase failure. The thermal overload relay can make up a compact starting solution together with contactors. It is an element which is connected to the output of the contactor to protect the motor.

OLR

MPCB (Motor Protection Circuit Breaker)

MPCB is generally used as Motor circuit breaker for low rating motors. it is a substitute of Thermal overload relay but with advance features. These are Thermomagnetic type,

- Thermal Protection for Overload while Magnetic is for Short circuit protection. Thermal Protection works with a bimetallic strip, the bi-metal strips are heated by the motor current, causing them to bend and activating the trip mechanism after a certain travel which depends on the current-setting of the relay.
- Magnetic coil is shaped in the form of a small coil. If a high over current flows through these coils, a force acts on the armature enclosed by the coil. This armature unlocks the loaded switch latch that releases the stored spring energy and hence opens the main contacts and disconnects the over current.

An MPCB

Electrical Insulation

Electrical shock caused by the flow of current through the human body can result in physiological effects raging from fatal injuries resulted by involuntary

moments to death from ventricular fibrillation (the rhythmic pumping action of the heart ceases) or muscular contraction.

DC voltage up to 40 volts and AC voltage up to 60 volts are considered safe limits, in the best circumstances, for the human body, but beyond this is consider a hazard, and to prevent it electrical insulation is required. Resistance to the electrical current is measured in ohms. Metals react with very little resistance to the flow of electrical current and are called conductors. As previously mentioned, materials like asbestos, porcelain, PVC, dry wood react with a high resistance to flow of electrical current and are called insulators.

Application of insulating materials

Cables and transmission lines:
Insulating material is generally used as a protective coating on electrical conductor and cables. Cable cores which touch each other should be separated and insulated by means of insulation coating on each core, e.g. polyethylene, cross linked polyethylene-XLPE, polyvinyl chloride-PVC, Teflon, silicone etc. Hanging disk insulators (bushings) are used in high voltage transmission bare cables where they are supported by electrical poles. Bushings are made from glass, porcelain, or composite polymer materials.

Electronics systems:
All electronic appliances and instruments widely contain PCB (printed circuit boards) having different electronics components on them. PCBs are manufactured of epoxy plastic and fiberglass. All electronics components are fixed on the insulated PCB board. In SCR (semiconductor rectifiers), transistors and integrated circuits, the silicon material is used as a conductive material and can be converted into insulators using a heat and oxygen process.

Power systems:
Transformer oil is widely used as an insulator to prevent arcing in transformers, stabilizers, circuit breakers, etc. The insulating oil can withstand insulating properties up to a specified electrical breakdown voltage. Vacuum, gas (sulphur hexafluoride), and ceramic or glass wire are other methods of insulation in high voltage systems. Small transformers, power generators, and electrical motors contain insulation on the wire coils by the means of polymer varnish. Fiberglass insulating tape is also used as a winding coil separator.

Electrical cable insulating tape:
PVC tapes are widely used to insulate electrical wires and other live conductive parts. It is made of vinyl as it stretches well and provides effective and long-lasting insulation. Electrical tape for class H insulation is made of fiberglass cloth.

Personal protective equipment:
PPE protects humans from the hazards of shock with electrical circuits. PPE such as insulating head protection, eye and face protection, and insulating gloves are necessary for protection against all common electrical hazards. Insulated tools and protective shields are must for an electrician's safe working. Dielectric shoes (non-metallic safety footwear) or electrical hazard footwear is made with non-conductive, electrical shock-resistant soles and heels.

Electrical rubber mats:
Insulating mats for electrical purposes have a wide application in various power plants, etc. The mats are used for floor covering below control panels to provide for the safety of workman due to any possible leakage of current.

Safety against Human Mistakes

Safety Switches

Safety switches are interlocking devices used to monitor (and sometimes lock) machine guards, doors, gates, windows, jaws or other machinery to protect both people and machines. A variety of safety switch styles are available to detect unsafe conditions and isolate power from the hazard.

Sensors

Sensors consist of two parts, a transmitter and a receiver. These are widely used in the doors of the machines which allow the workers to manually make changes, change tools and remove parts. By mistake if any user puts their hand

inside the glass door then the sensor will sense the input and automatically send information to the control circuit to terminate the action.

Double Push Buttons

Sometimes a worker may accidentally press the start push button and the machine will start running. This could prove to be fatale if any other working would be performing a check on the machine. Hence, Double Push Buttons are used which have to pressed at the same time to start the machine. If either of the buttons isn't pressed, the machine won't start.

Mechanical Safety Controls

These include the clamps, jacks, the levers etc. which have a more mechanical operation to perform and are pneumatically or hydraulically operated to start or stop the machine.

Online Maintenance Management Software

- At Honda Siel Power Products Ltd. A software called E-Byte is used to manage Break downs, Preventive Maintenance and spare parts flow. The software not only raises a break down, it also saves all information related to it like total downtime of a machine, spares issued, manpower cost etc.
- The software is also responsible for saving record about Preventive Maintenance performed and the minimum and maximum value of critical spares. This software is extremely useful as it saves a lot of time and energy.
- The software also monitors continuous safety improvements taking place inside the plant.

Other Safety Measures

Gas Leak Detectors

A gas detector is a device that detects the presence of gases in an area, often as part of a safety system. This type of equipment is used to detect a gas leak or other emissions and can interface with a control system so a process can be automatically shut down. A gas detector can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave. This type of device is important because there are many gases that can be harmful to organic life, such as humans or animals.

A Gas Leak Detector

Smoke Detectors

A smoke detector is a sensor that detects smoke as a primary indication of fire. It provides a signal to a fire alarm system in a large building or produces an audible and visual signal locally in a room or a home. Smoke detectors are usually housed in a small, round shaped plastic case, and placed at the roof where there are risks of fire or fire hazards.

A Smoke Detector

Manual Call Points

Manual Call Points are essentially just another form of fire detection – the difference is that we are the detector. They make it easy to make it known that there is danger from fire on the premises and that action needs to be taken. Manual call points are normally installed as part of a fire alarm system at regular intervals throughout a building, it is even possible to buy weatherproof manual call points that can be positioned outside. The call point will be connected on a loop to a fire alarm control panel and when we activate the manual call point, what we're actually doing is sending a message to the control panel to let it know that there is a fire danger in our immediate area. The person in charge of monitoring the control panel will be able to see that the alarm has been activated and investigate and take action on our behalf. Some control panels even send automatic messages to the emergency services.

Alarm monitoring

Alarm monitoring is quick and detailed communication between our home security system and the central station of our security provider. The control panel registers an emergency event and sends a signal to the central monitoring station, where the appropriate authorities are notified and sent to our home. For example, a smoke detector event will cause the alarm monitoring service to contact the fire department, while the signal from a medical alert pendant will be routed to ambulance or paramedic services.

Auto shut off systems

When any abnormalities are experienced by a machine it senses leakage, presence and automatically shuts down the operation. The machine can later be restarted and put back to work without having any casualties.

Machine Circuits

Control Circuit

Control circuit is a special type of circuit used to control the operation of a completely separate power circuit. Consider a 1,000 horsepower, large industrial motor driving a water pump. The motor is connected to a high voltage electrical supply of 2,400 volts.

When this motor is energized, it must draw enough current to get the water moving and it is common for a motor to draw about six times its normal operating current for a short period of time. When we were talking about controlling light bulbs, it was safe to operate a simple switch on the wall. But now this large amount of current flowing when the motor starts can be troublesome. The first concern is the operator's ability to safely close the switch. The second concern is that when the operator opens the switch to turn the motor off, the electricity will continue to try to complete the path. This will tend to arc between the contacts of the switch as it is opened. This arcing is not only dangerous but also damages the switch by severely burning the contact points. A control circuit is used to ensure that the motor is started and stopped in a safe manner for both the operator and the equipment.

A common control circuit example is the thermostat to the air conditioner in a house. The thermostat is part of a low-voltage control circuit that controls a relay that actually energizes and de-energizes the power circuit to the air conditioning compressor.

Power Circuit

A power circuit is defined as any circuit used to carry electricity that operates a load. This may seem like a simplistic definition but it is important to distinguish power circuits from control circuits since they serve different purposes.

A circuit with an outlet for the source, two wires for the path, a switch for the control device and a motor for a load is a good illustration of a power circuit. When the switch is closed, the electrons flow through the path and the electrons go directly through the motor windings and cause the motor to operate. The only circuit control in this circuit is the switch wired directly in series with the motor. There is no separate control circuit associated with this

power circuit. Most lighting and receptacle outlet circuits in a house are power circuits since they only provide power to devices when the devices operate, and the circuit control is part of the power circuit.

PLC Ladder Circuit

A PLC has many “input” terminals, through which it interprets “high” and “low” logical states from sensors and switches. It also has many output terminals, through which it outputs “high” and “low” signals to power lights, solenoids, contactors, small motors, and other devices lending themselves to on/off control. In an effort to make PLCs easy to program, their programming language was designed to resemble ladder logic diagrams. Thus, an industrial electrician or electrical engineer accustomed to reading ladder logic schematics would feel comfortable programming a PLC to perform the same control functions.

PLCs are industrial computers, and as such their input and output signals are typically 120 volts AC, just like the electromechanical control relays they were designed to replace. Although some PLCs have the ability to input and output low-level DC voltage signals of the magnitude used in logic gate circuits, this is the exception and not the rule.

Signal connection and programming standards vary somewhat between different models of PLC, but they are similar enough to allow a “generic” introduction to PLC programming here. The following illustration shows a simple PLC, as it might appear from a front view. Two screw terminals provide connection to 120 volts AC for powering the PLC’s internal circuitry, labelled L1 and L2. Six screw terminals on the left-hand side provide connection to input devices, each terminal representing a different input “channel” with its own “X” label. The lower-left screw terminal is a “Common” connection, which is generally connected to L2 (neutral) of the 120 VAC power source.

Manual VS CNC Machines

Manual machines are controlled by an arrangement of Cams and gear wheels. Simple linear trajectory of the part being machined or the tool being used can be controlled through hand operated or automated wheels that are connected to screws or rack and pinion arrangements. Complex paths are usually controlled by some kind of a cam follower device which follows a master template. Precision was realised by very high reduction ratio gear sets, which enabled movement of the resolution of microns by rotating a hand wheel by one turn or a fraction of a turn using marked dials or dial wheels. This arrangement requires great manual skills and hard stops to make precise features. It is analogous to an analog system.

Numerical controlled machines on the other hand use servo motors, encoders and ball screws. The servo motor can be instructed to rotate even as little as a fraction of a degree. Normally used ball screws have a pitch of around 10mm. Therefore, one rotation of the ball screw moves the part or tool by 10 mm. By precisely controlling the rotation, even movement as small as nanometric resolution can be obtained on modern machines. Most normal modern machine tools can make movements of 1-micron resolution quite reliably. The encoders provide a closed loop feedback to the servo motor driver, which makes for very precise positioning and thereby great accuracy of the machined part. These instructions can be numerical, and hence the name Numerical control.

Usually, the tool and the part are moved relative to each other by manipulating three servo motors on the x, y and z axes, which are linear axes. More complex movements can be achieved by incorporating rotary axes around the linear axes which are termed a, b and c axes. Very few machine tools have rotary axes, but that seems to be changing these days.

In a Numerically controlled machine, the trajectory (also known as tool path) and its velocity (also known as feed rate) is controlled by simultaneously varying the speed and direction of the servo motors which control the linear and rotary axes. This involves complex trigonometric and velocity calculations in real time based on real time feedback from the encoders. These calculations are carried out by the numerical controller in real time.

In the early days of Numerically controlled machines not much interaction was possible between the machine controller and humans. As has been pointed out, communication was rather limited through punch cards or tape. The machines only contained the Motion control kernel and not much else beyond that. Programs had to be manually written at the most basic level and fed into the machines.

Modern CNC machines however are much more advanced and have full-fledged PCs which permit all kinds of interaction with the user. they can be networked through ethernet, RS232, accept Compact flash cards, USB drives etc.

There isn't much difference between NC machines and CNC machines except in their ability. CNC machines accept programs in the form of G Codes which are instructions that provide the direction and speed for the tool trajectory. Many modern CNC permit high level programming of complex parts at the machine interface itself. Many common features are inbuilt as parametrized canned cycles

PLC (Programmable Logic Controller)

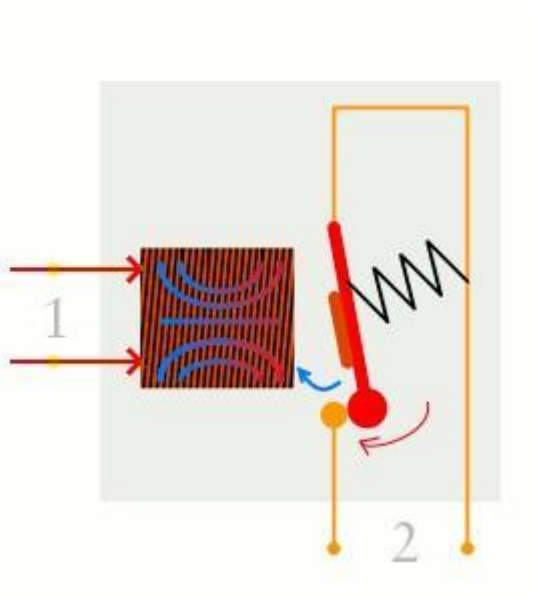
PLC (Programmable Logic Controller) is a ruggedized industrial computer. PLC has a series of inputs and outputs which can be as few as 4 to 8 to may be a hundred or more through addon Input Output (IO) modules. The inputs receive signals from sensors and outputs activate motors, valves, signals, through relays and switches. The PLC works on a sequential scan cycle. The PLC examines the inputs for their signal status, which is mostly binary (on or off) and based on the logic programmed into it, activates the outputs. PLCs can also control servo and stepper motors. Their programming is in a strange language which looks like a circuit diagrams involving relays. It seems the PLC was developed to replace the cumbersome circuit of relays which was used to control early machine automation. CNC machines also have a PLC to control all the peripherals, interlocks and signals. For e.g. a PLC may prevent a chuck from being de clamping on a CNC turning machine when it is in operation. PLCs are good enough for many kinds of automation without requiring NC or CNC.

What is a Relay?

A relay is an electromagnetic switch operated by a relatively small electric current that can turn on or off a much larger electric current. The heart of a

relay is an electromagnet (a coil of wire that becomes a temporary magnet when electricity flows through it). You can think of a relay as a kind of electric lever: switch it on with a tiny current and it switches on ("leverages") another appliance using a much bigger current. As the name suggests, many sensors are incredibly sensitive pieces of electronic equipment and produce only small electric currents. But often we need them to drive bigger pieces of apparatus that use bigger currents. Relays bridge the gap, making it possible for small currents to activate larger ones. That means relays can work either as switches (turning things on and off) or as amplifiers (converting small currents into larger ones).

How does it work? (NO/NC Operation)



The Input Circuit:

When power flows through the first circuit (1), it activates the electromagnet (brown), generating a magnetic field (blue) that attracts a contact (red) and activates the second circuit (2). When the power is switched off, a spring pulls the contact back up to its original position, switching the second circuit off again.

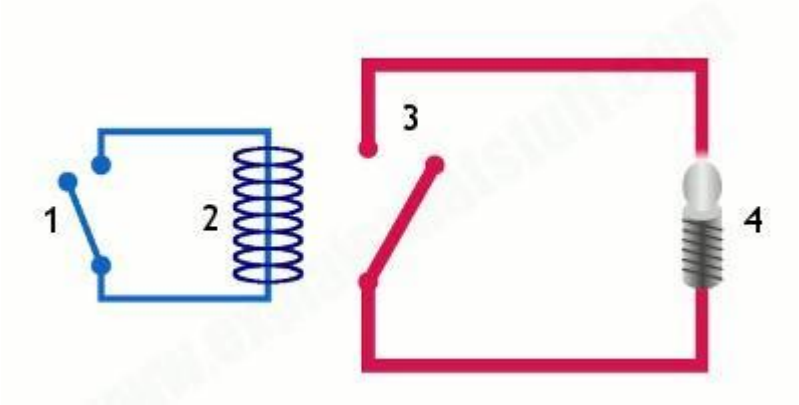
This is an example of a "normally open" (NO) relay: the contacts in the second circuit are not connected by default, and switch on only when a current flow through the magnet. Other relays are "normally closed" (NC; the contacts are connected so current flows through them by default) and switch off only when the magnet is activated, pulling or pushing the contacts apart. Normally open relays are the most common.

1. It's essentially the same thing drawn in a slightly different way. On the left side, there's an input circuit powered by a switch or a sensor of some kind. When this circuit is activated, it feeds current to an electromagnet that pulls a metal switch closed and activates the second, output circuit (on the right side). The relatively small current in the input circuit thus activates the larger current in the input circuit (blue loop) is switched off and no current flows through it until something (either a sensor or a

switch closing) turns it on. The output circuit (red loop) is also switched off.

2. When small current flows in the input circuit, it activates the electromagnet (shown here as a dark blue coil), which produces a magnetic field all around it.
3. The energized electromagnet pulls the metal bar in the output circuit toward it, closing the switch and allowing a much bigger current to flow through the output circuit.
4. The output circuit operates a high-current appliance such as a lamp or an electric motor.

The output circuit:



Pressure Switch and It's Working

In its simplest form a pressure switch will indicate, electrically, when a system has reached a defined pressure. Pressure enters through the connection port and acts on the diaphragm or on the piston (piston types are used for higher pressure). If the force resulting from this pressure is greater than the force exerted by the pre-loaded switch point set spring then the plunger moves taking with it the contact disc, which closes the circuit between the contacts. When the pressure falls again by an amount greater than the hysteresis the switch opens again. For a normally closed switch the action of the contacts is reversed. By turning the set screw the pressure switch can be adjusted within its pressure switching range. By using a micro-switch with changeover function, the normally open and normally closed operation can be combined into a single pressure switch. The plunger operates a swivel contact. In the un-pressurised state, the circuit is closed by the normally closed contact. If the pressure applied exceeds the adjusted set point then the swivel contact changes and closes the circuit using the normally open contact.

Overview

Basic Components of an Electrical Circuit

Safety Components

MCB (Miniature Circuit Breaker)

MPCB (Motor Protection Circuit Breaker)

MCCB (Moulded Case Circuit Breaker)

Fuse

Emergency Push Button

Overload Relays

Controlling Components

Pushbutton

Control Relays

Limit Switches

Drive

Programmable Logic Control (PLC)

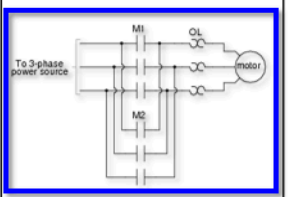
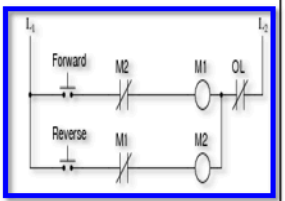
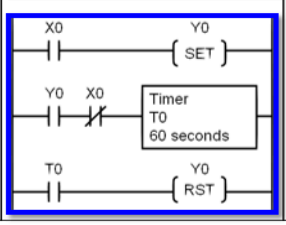
According to the type of control , machines can be divided into three parts namely Relay Logic operated , Computer Numeric Control Operated and Programmable Logic Control operated.

S.N.	Description about Learning	Type	Picture	Description
1	Types of Machines According to Control	Relay Logic Operated		**Relay logic** machines work on the principle of Normally Open and Normally Closed operation of relays.
		Computer Numeric Control (CNC) Operated		**CNC** involves the use of computers to control machine tools.
		Programmable Logic Control (PLC) Operated		A **PLC** is computer control that continuously monitors the state of input devices and takes output decision

There are namely four circuits involved in working of machine that include Hydraulic Circuit, Pneumatic Circuit, Electrical Circuit and Lubrication Circuit.

S.N.	Description about Learning	Type	Picture	Description
2	Types of Circuits	Hydraulic Circuit		A Hydraulic circuit is a system that uses pressurized hydraulic fluid to power hydraulic machinery.
		Pneumatic Circuit		A Pneumatic circuit is a system that uses compress air to transmit and control energy.
		Electrical Circuit		An Electric circuit is a circuit that helps in transmission of electrical power to various electrical components.
		Lubrication Circuit		A Lubrication Circuit is used to provide lubrication at points in machine that are vulnerable to wear and tear.

In fault finding the circuit diagrams involved can be of four types , power circuit, control circuit and PLC ladder diagram .

S.N.	Description about Learning	Type	Picture	Description
3	Understanding the Types of Circuit Diagrams	Power Circuit		A power circuit is a circuit that provides significant electrical supply to component that needs constant load.
		Control Circuit		A control circuit provides a much lower level of power to operate control logic, contactors, displays, relays, and communications.
		PLC Ladder Diagram		A PLC ladder diagram is used to know about the inputs and output commands of PLC.

Breakdown Project

Project: *Safety improvement by PLC Circuit Modification*

Date: *30.05.18*

Machine Code: *M/C-2442*

Machine Name: *Parallel Key Way Milling*

Co-Worker: *Mr. Abid Ali*

Spare Parts used

1. Relay 230VAC MY4N- 1
2. Pressure Switch- 1
3. MY4N Relay Base- 1
4. Connector- 2
5. Wiring- 0.5mts

MY4N Relay with base

Machine Operation

Key ways are grooves of different shapes cut along the axis of the cylindrical surface of shafts, into which keys are fitted to provide a positive method of locating and driving members on the shafts. A keyway is also machined in the mounted member to receive the key.

Problem with the Machine

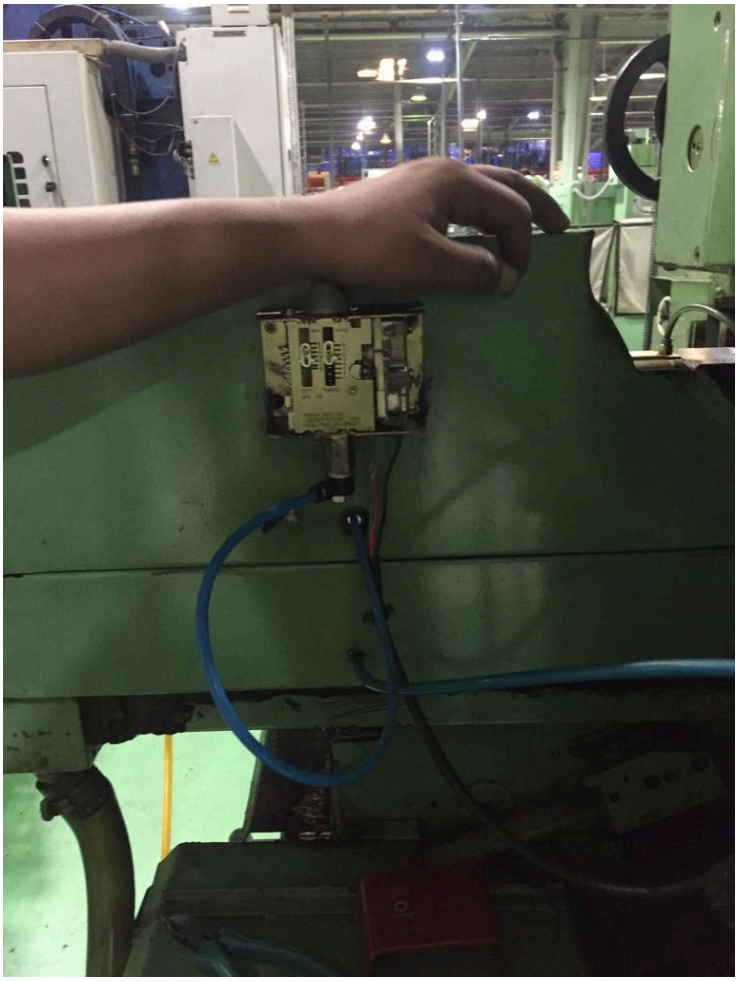
A pneumatic clamp is used to operate the machine. After pressing the start button on the control panel, the machine starts the cycle in clamping mode. When the machine is de-clamped, the cycle should stop so that machine operation can be restarted. The problem with the Machine was that when the lever was de-clamped, the cycle did not stop and the machine kept running. This could be risky as a person who'd run a machine with de-clamp part can be at safety risk. Hence, to ensure the safe working of the machine a circuit modification was performed on the machine's control panel.

The Component Clamp Pressure Switch

First Impressions and Approaches

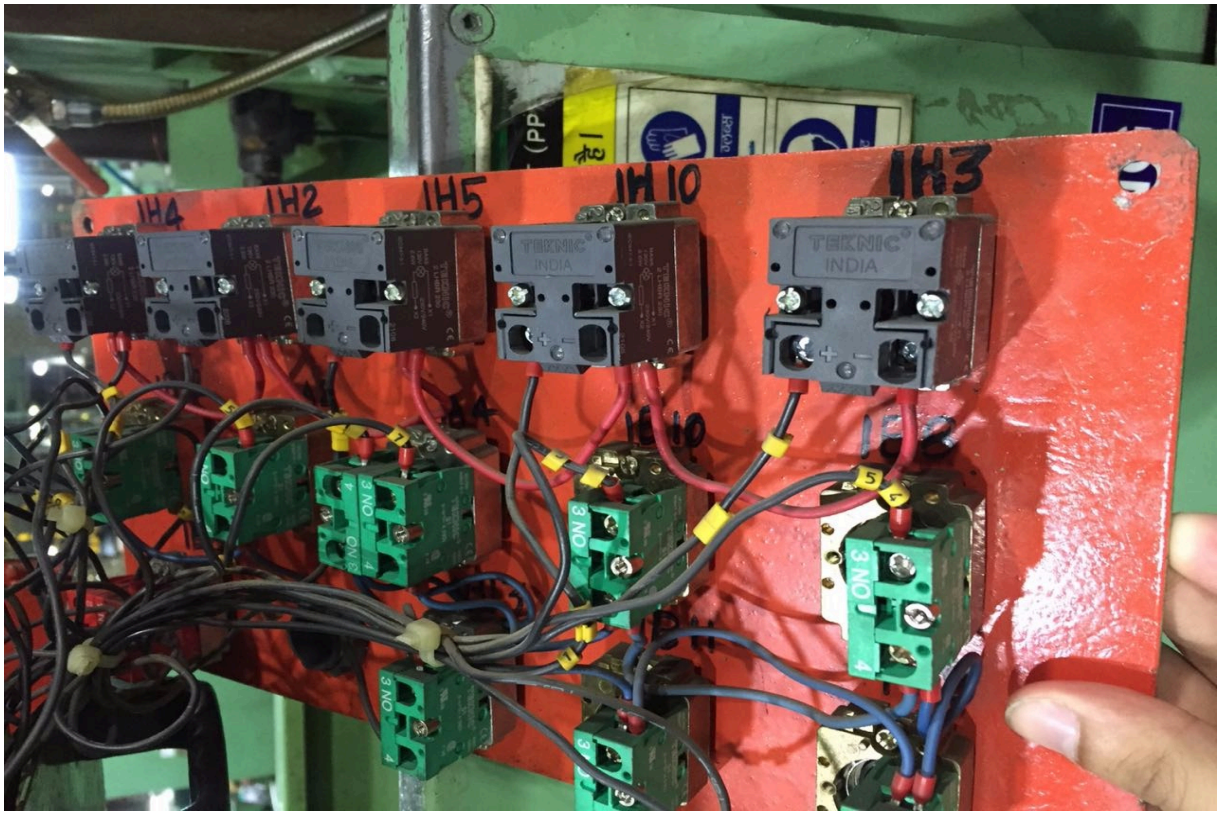
At first it just seemed liked the machine wasn't being operated properly. So, the steps to start and stop the machine were performed repeatedly to confirm the breakdown. After that the operating panel was thoroughly checked for any wiring issues or any problems with the push buttons and their contacts or bezels. There wasn't any such issue. Then it was decided to go for the programmable logic approach and redesign the panel circuit by adding a relay, hence performing a PLC circuit modification.

Pressure Switch Connections



The Control Panel

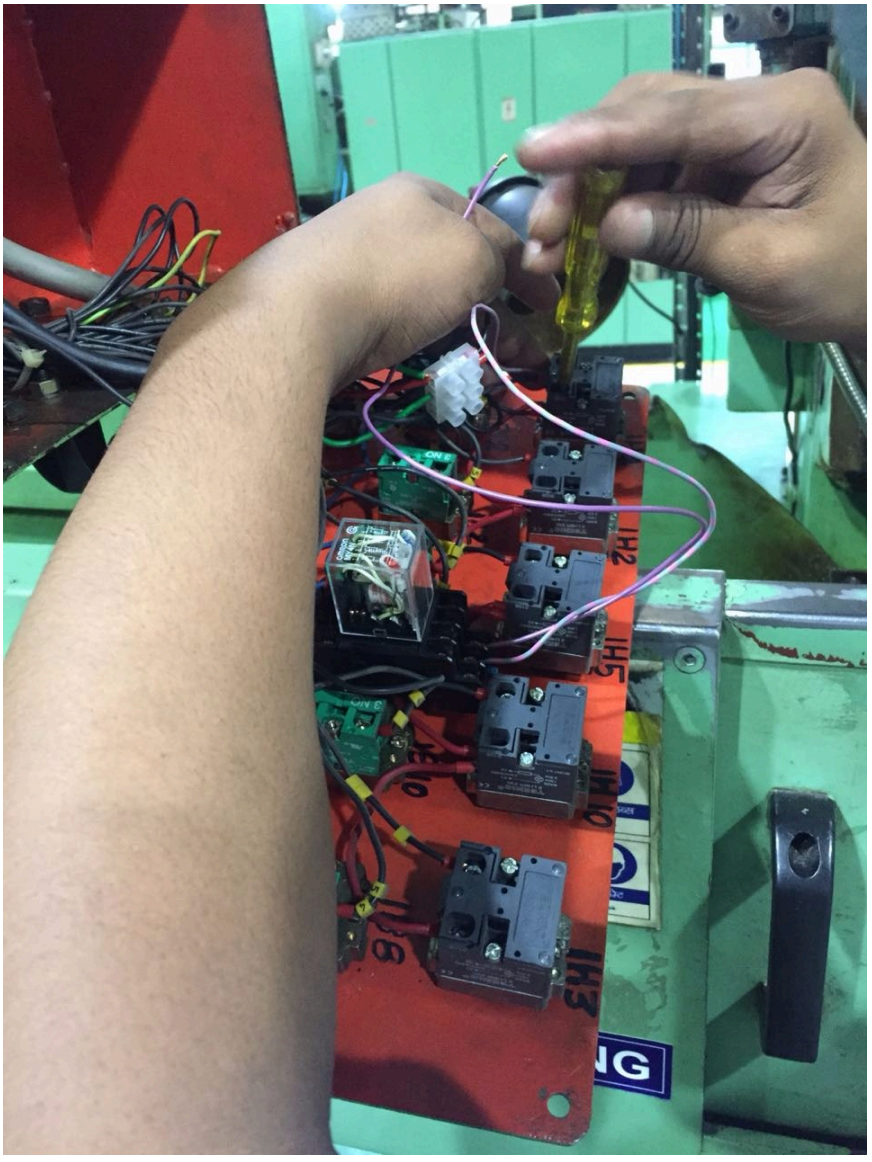
Push Buttons-Toggle circuits and the Contact Blocks



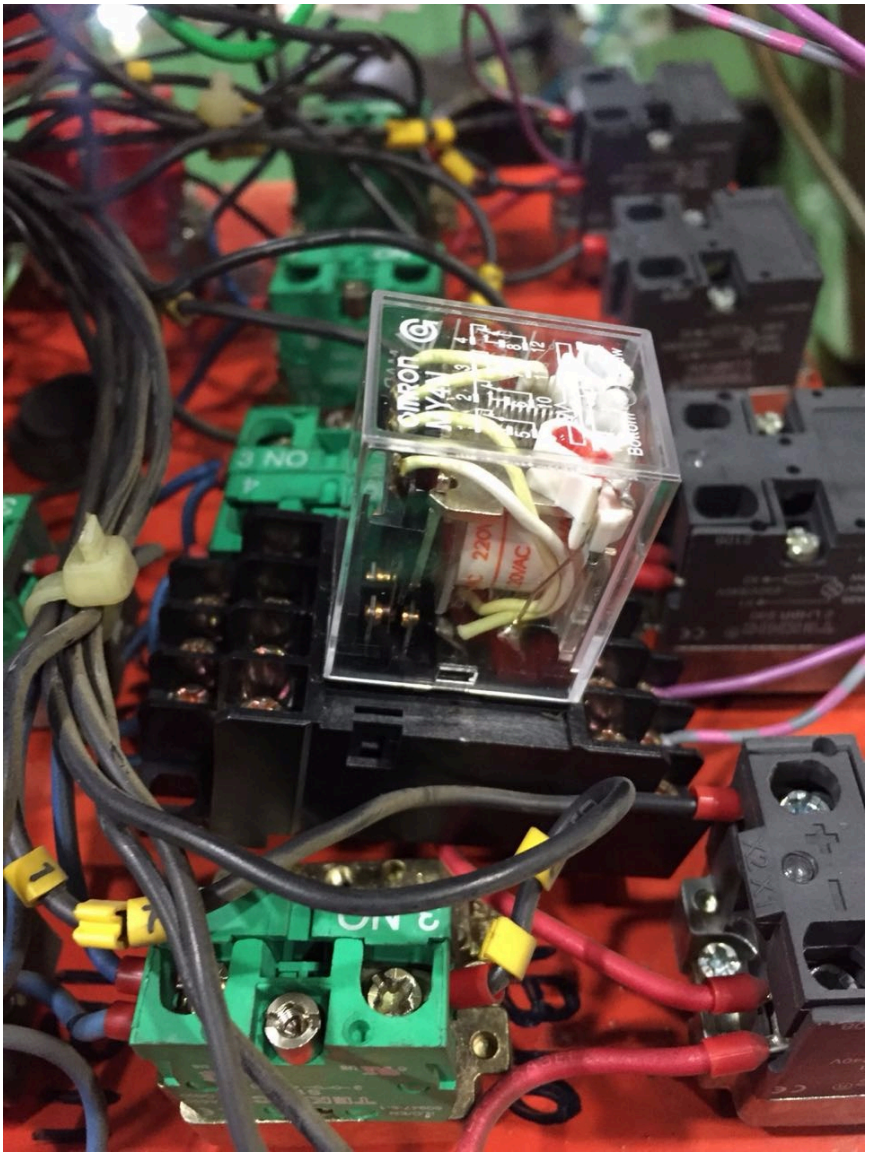
Rectification

An MY4N 230VDC Relay was added to the circuit. Between the start push button and the autocycle running push button. We did not require a second relay as one signal was provided by the incoming three-phase line itself. All the panel control settings were put to default before testing the machine following the circuit modification. After that the usual steps to operate the machine were followed and the clamping-de-clamping operation was performed repeatedly to ensure the proper working of the machine.

Relay being connected to the operation circuit



Relay as a part of the operation circuit

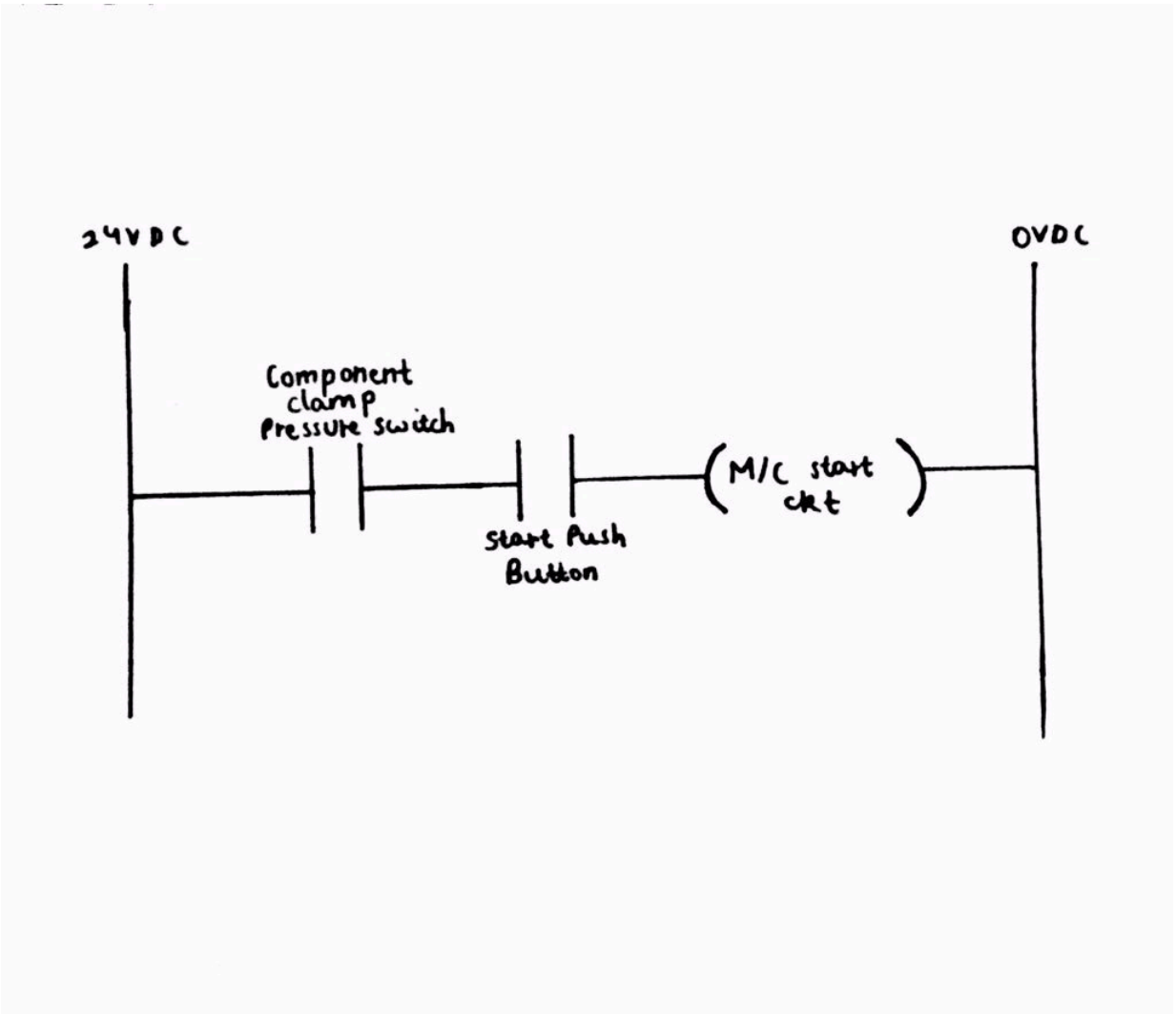


Circuits

Before Circuit:

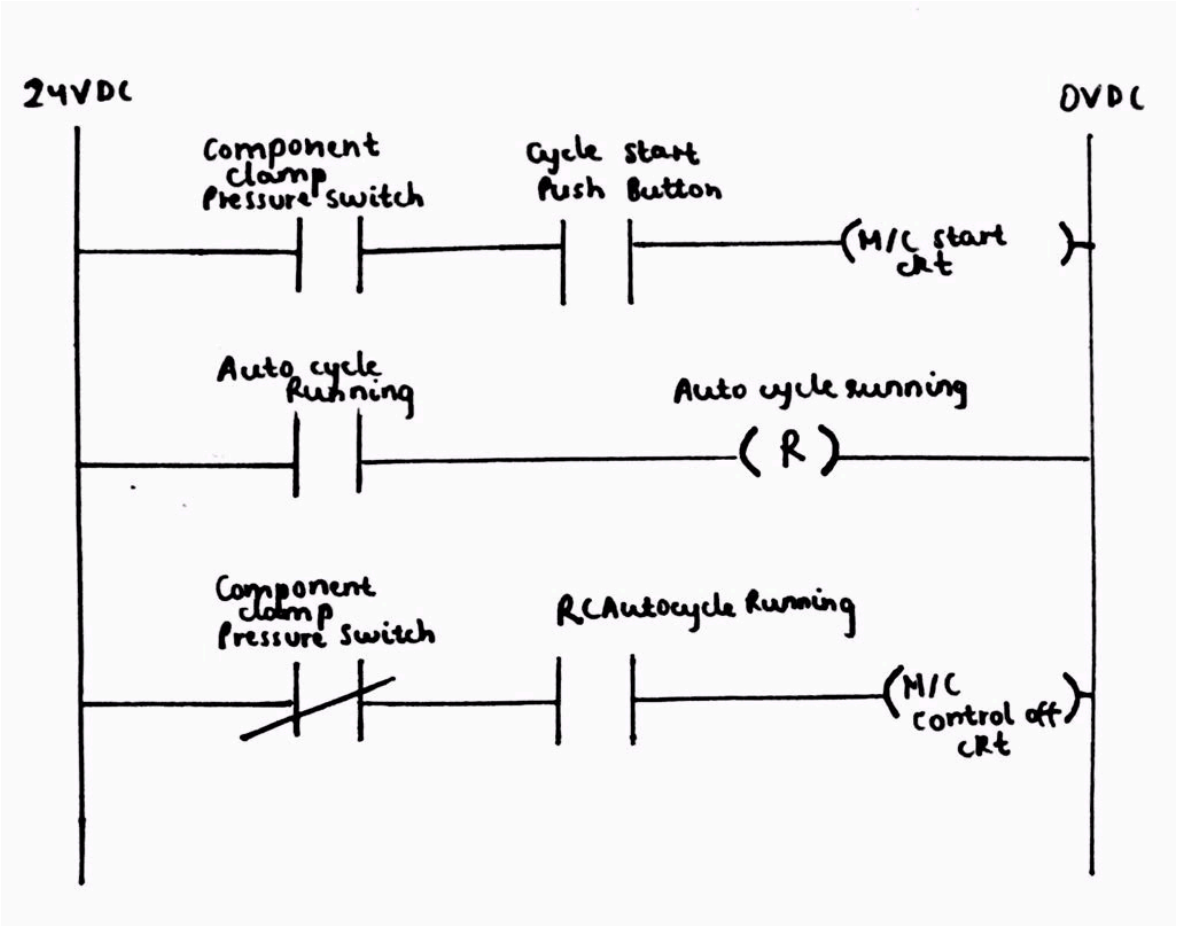
All the devices in this circuit are in NO (Normally Open) position initially. As soon as the component clamp pressure switch is activated and the start button is pushed, the machine starts working. This essentially means that now the

clamp pressure switch and start push button are in NC (Normally Closed) position.



After Circuit:

After performing the modification while the autocycle is running, the component clamp is activated and the machine keeps running. However, when the pressure switch is de-clamped then the active relay position changes from (NO) Normally Open to (NC) Normally Closed which triggers the Machine Control Off circuit. For this operation both the pressure switch and the stop button have to be closed.



Result

The machine ran smoothly and the stop operation worked properly after the modification was made in the circuit. This not only ensured the proper working of the machine but also reduced the risk factor as the safety had been improved. If a person wanted to immediately stop the cycle while working on it because of any reasons he/she would be able to do so without any risk.

Conclusion

The month-long internship at Honda Siel Power Products Limited has indeed been a very fruitful one. On the whole, this internship was a useful experience.

The internship was also good to find out what my strengths and weaknesses are. I was able to learn more about the various safety devices that are used in a plant. Apart from that I got to know about how the various machines are maintained and how we can ensure the smooth working of all the machines and devices. In addition to that I was able to learn more about certain imperative devices like Relays, Pressure Switches etc. which broadened my knowledge. I was introduced to PLC programming which is extremely useful in the current electrical systems and also had the opportunity to observe different types of machines and their circuitry.

I have gained new knowledge, skills and met many new people. I achieved several of my learning goals.
I got insight into professional practice and learned the different facets of working at a huge Company.

This helped me to define what skills and knowledge I have to improve in the coming time and will work extremely hard to do so.