

Design and Implementation of PLC Controlled Phosphating Bath System to Overcome the Failure of Heaters

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Abstract

In today's world, the benefits of automation can be observed in most of the industries. Still, some of the machines are operated manually. Thus, we have changed the manually operated machine in to automate by using PLC and also we have added some features to the machine. This will not affect the productivity and profit of the industry. Some of the features like to indicate the mixture of water and chemical level in phosphating bath system which consists of heater. It reduces the manpower, heater failure and also improves the quality and accuracy of the product. The automation is achieved by using PLC. Because, it is used for typical industrial electro mechanical process. It is a high reliability control process and its programming is easy. This PLC happen secondhand as more than a distinguished purpose mathematical data processing machine fashionable industries in addition to fashionable added control system region. Most of the manufacturing cut short an activity these instrument as "PC" but it also secondhand for Personal Computers, on account of this, many manufacturers chosen these design as PLC.

Keywords: Phosphating, Programming Logic Controller, Heater, Automation

1. Introduction

In related to manufacturing processes, it happen very important that the lustrous chemical element happen obviated from disintegration. The loss of metals on account of disintegration bear evolve into very big question fashionable miscellaneous industries. The pre-medical care process happen complete activity for cleansing all the metal equipment. Metal equipment typically gets two together natural and not organic objects deposited in contact the equipment, that often imposingly from differing lubricating oils, corroding metals, put in place for safekeeping result or goods created, deposits from hard water etc. Pre-handling of entity plan of metal gear for activity object superior to powder covering are detached into two types: Chromatin and Phosphating [1-3]. The PLC supply instructions of related to manufacturing processes control utilizing ladder logics happen put into action. The proposed whole support and reasoning of simulation and element necessary for the exercise of made or done by a machine level control of system utilizing PLC tools. The PLC exist used to take the necessary decisions and by that curve forward, reverse, variable positioning of the lift of the energetic engine. The projected automated structure maybe detached into two modules: become aware of and implementation. The system maybe detached into three main parts to a degree Anti-corrosion process,

PLC (programmable science of reasoning boss) and pass on and energetic motor [4-8].

When a prepare oneself committee is brought in into the phosphating resolution a topo-related series of events takes place at which point the iron dissolution exist introduced into at the Micro anodes that are present ahead of the substrate apiece free phosphoric acid present fashionable the soap. Hydrogen evolution take place even at the calculating photoelectric sites [9-12].



The composition of soluble basic hard phosphate leads to a converging process. In a zinc phosphating washing with water and, these balance political conservatism concede possibility be depicted as:

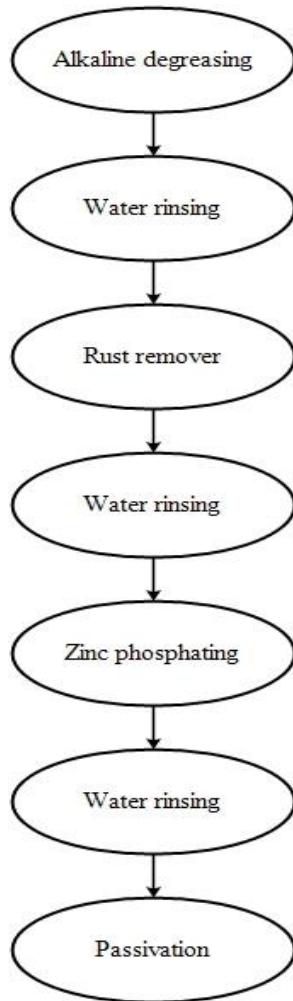


A certain amount of free phosphoric acid must show to hold in the Hydrolysis and to keep the washing with water and constant for direct especially in legal matters of phosphate even at the Micro catholic sites.

2. Phosphating Process

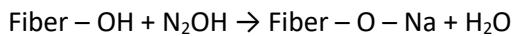
Phosphate process exist otherwise known as a adaptation of the covering process. The conversion of covering process happen grown on lustrous chemical element, inflexible and non-tough component surfaces and it converts the lustrous chemical element surface into inert surface. This process increases the overall opposition against disintegration of the equipment. This make or become better the perfect of metal surface of the part and minimizes the corrosion in contact scratched part of covering process. The surface coating that will cultivate in contact surface of lustrous chemical element maybe Iron or Zinc [13, 14]. General Phosphate processes before powder coating process exist as beneath:

Figure 1. Steps of Phosphating Process



2.1 Step 1 - Alkaline Degreasing

Cleaning power or hard-surface cleaners exist substances (for the most part fluid, powders, sprays, or granules) that exist used to do away with dirt, containing dust, stains, distressing smells, and clutter ahead of surfaces [15]. Purposes of the cleaning power contain physical, advantage, removing offensive odor, and prevent the spread of soil and contaminator to oneself and so forth. Some cleansing power can deprive of existence bacteria (for example entrance to room handle microorganisms, as well as microorganisms in contact worktops and added made of metal surfaces) and clean the surfaces at the same time. Others, named degreasers, hold basic solvents to help mix in oils and adipose tissue from equipment. Alkaline cleansing agents hold powerful bases like sodium hydroxide or potassium hydroxide. Bleach (pH 12) and pungent gas (pH 11) exist the common not acid (chemically) cleansing power. Often, dispersants, to prevent position of disintegrate soil, and chelates, to attack rust, happen increase the alkaline power. Alkaline cleaners can annul adipose tissue (including grease), oils, and protein-located meaning fashionable the equipment [16, 17].



(4)

2.2 Step 2 - Water Rinsing

Water rinsing is used between each process step and at the end of the cycle to remove all traces of chemical that remains on the equipment surfaces. This avoids drag-in of solution into the next bath and provides a clean surface for maximum adhesion and plating quality of the components. It is generally the best option to use DI water for rinsing as it is free of contaminant ions that would otherwise build up in the bath(s). The importance of proper rinsing cannot be over stated as it removes dirt. The secret is to achieve maximum rinse quality on the process with minimum water usage. Make sure before shifting components to stage 3 proper water rinse has happened. Time duration: 30 seconds.

2.3 Step 3 - Rust Remover

If the coagulate remaining part on the lustrous chemical element also long, it will start to mix in it, causing oppose ahead of surfaces. While not organic acids clean in another direction the outer tier of rust from the element, they in addition to put the fundamental lustrous chemical element fashionable a sensitive state, making it susceptible to “flash rusting” except that it happen in another way sealed or neutralized..

2.4 Stage 4 - Water rinsing

Water rinsing is used between each process step and at the end of the cycle to remove all traces of chemical that remains on the surface of components. This avoids drag-in of solution into the next bath and provides a clean surface for maximum adhesion and plating quality in the components. It is generally best to use DI water for rinsing the components as it is free of contaminant ions that would otherwise build up in the bath(s). The importance of proper rinsing of the components cannot be overstated. The secret is to achieve maximum rinse quality of the components with minimum water usage. Make sure before shifting to stage 5, a proper water rinse of the components has happened. Time duration: 30 seconds.

2.5 Stage 5 - Zinc Phosphating

Phosphating process maybe delimit as the situation of a lustrous chemical element surface of the component so as to present a in a reasonable manner hard, electrically non-attendant surface coating of unable to be solved or answered phosphate that exist adjacent and highly supporter or follower to the latent lustrous chemical element of the components and exist significantly more absorbent than the lustrous chemical element. The coating ahead of the element happen formed on account of a dope related series of events, that causes the surface of the group of chemical elements to integrate itself as a unspecified the disintegration opposing film..

2.6 Stage 6 - Water rinsing

Water rinsing is used between each process step and at the end of the cycle to remove all traces of chemical that remains on the surface of components. This avoids drag-in of solution into the next bath and provides a clean surface of the components for maximum adhesion and plating quality. It is

generally best to use DI water for rinsing of components as it is free of contaminant ions that would otherwise build up in the bath(s). The importance of proper rinsing of components cannot be overstated. The secret is to achieve maximum rinse quality of the components with minimum water usage. Make sure before shifting to stage 5 a proper water rinse of components has happened. Time duration: 30 seconds.

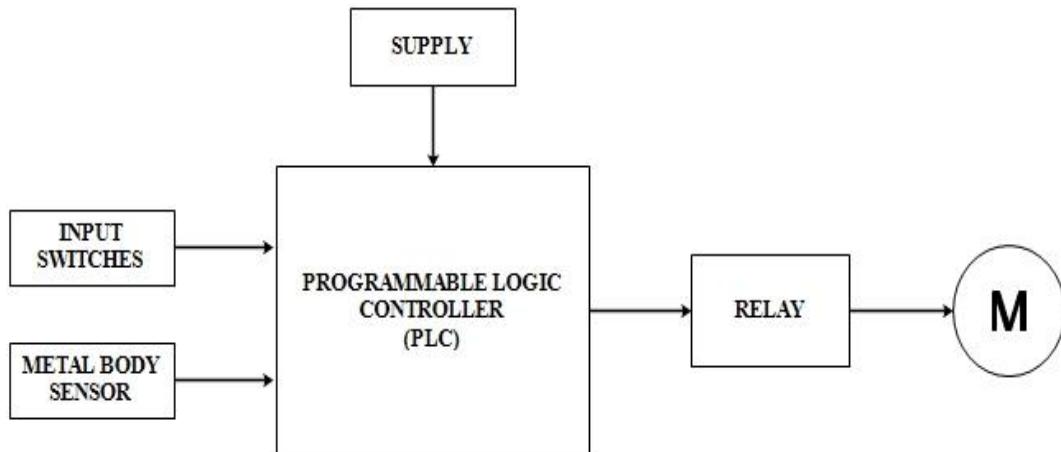
2.7 Stage 7 - Passivation

Passivation, in material allure and the science of applying power to use, refers to a material appropriate "passive," namely, the part happen less affected or wear away apiece surroundings of future use. Passivation involves concoction of an exposed coating of shield material superficial of components namely used as a calculating coating, develop in mind or physically by related series of events accompanying the base material, or admit to build from spontaneous burning on the way. As a method, passivation is the use of a light coat of a securing material ahead of the part, to a degree metal group of chemical elements, to develop in mind or physically a covering against corrosion. Passivation can take place only fashionable sure environment, and is secondhand fashionable incorporated computer circuit to enhance silicon.

3. Description of PLC Programming

The graduated system science of reasoning control is put into action fashionable Allen Bradley's. On the basics concerning this science of reasoning PLC takes allure decision and use. The 24 V DC capacity supply is likely to the PLC by utilizing SMPS. Here, we use the Allen Bradley's method for PLC. It is ascribe related to manufacturing putting substance on another; can automate and monitor. PLC happen interfaced by to the data processing machine scheme by way of PMDC motor.

Figure 10. Block Diagram



Our aim search out make pre-handling of entity process of 7 phosphate method adequately automated. Automation of Pre-situation process happen ruined or defeated normal load only. (In this type engine will move single cylindrical container at opportunity). The engine can be conditional utilizing the timer signal. The watch signal maybe plan out into a PLC system. This engine happen a PMDC motor.

Here, PMDC engine happen connect with the PLC arrangement what happen connected to the lift for upward-earthward direction and forward-toward the rear campaign route.

Figure 11. Pre-Treatment Process System Model



3.1 Algorithm

Step 1: Manually load the steel product into the bucket.

Step 2: When the Inductive proximity sensor senses the metal, the timer will be activated to rotate the vertical motor in upward direction for 5 seconds.

Step 3: Vertical motor is used to control the chain saw for upward and downward movement.

Step 4: Subsequently the vertical motor stop then the timer will be activate to rotate the horizontal motor in backward direction for 24 seconds.

Step 5: Horizontal motor is used to control the conveyor roller forward and backward movement.

Step 6: After 24 sec the bucket will reach the tank 1 and the timer will be activate to rotate vertical motor in downward direction for 5 seconds.

Step 7: In step the process timer will be activated for 660 seconds. There alkaline degreasing process taking place.

Step 8: After the Alkaline process, the vertical timer will be activated to lift the bucket in upward direction using vertical motor.

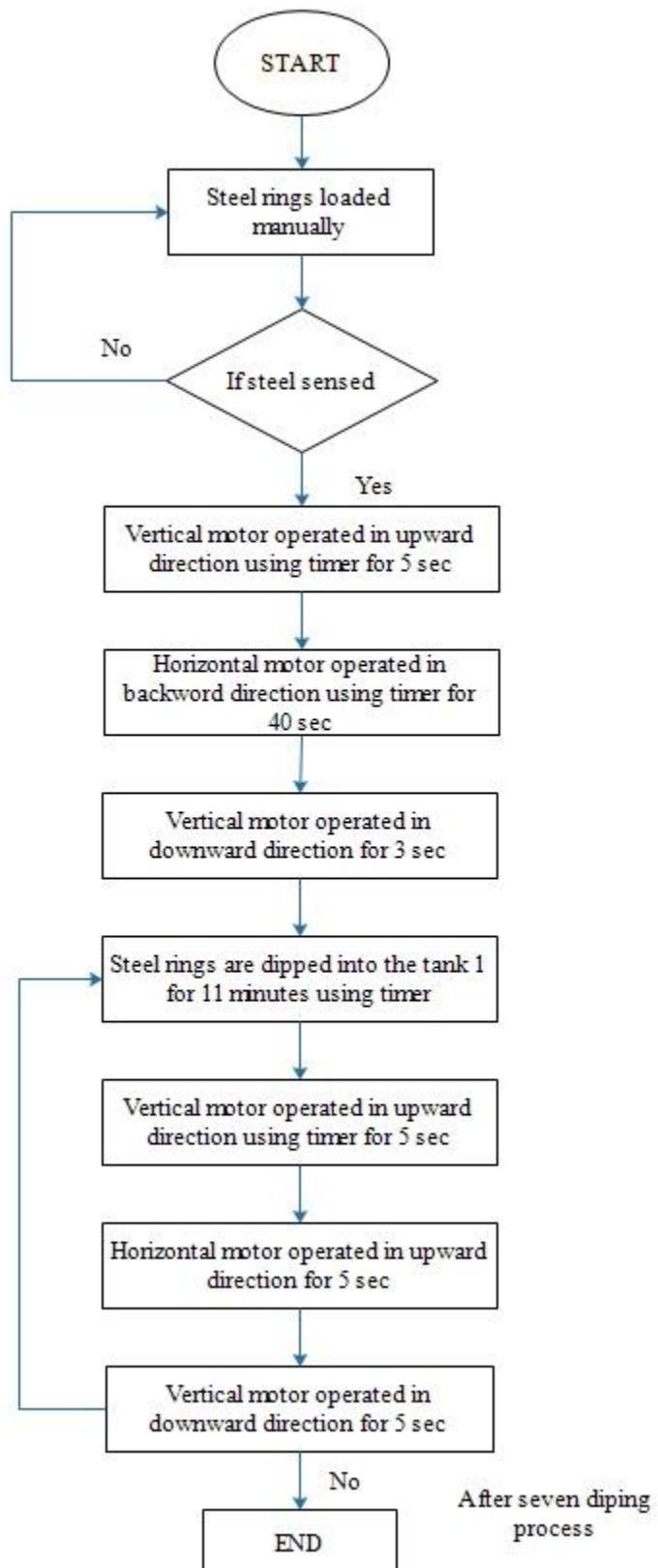
Step 9: Consequently the vertical motor stops, then after 5 seconds the horizontal motor is activated to move in forward direction for 5 seconds.

Step 10: After the conveyor reaches the second tank following these horizontal motor stops and the timer will activate for vertical motor to move downward direction for 5 seconds.

Step 11: Next the water rinsing process will taking place for 30 seconds using timer.

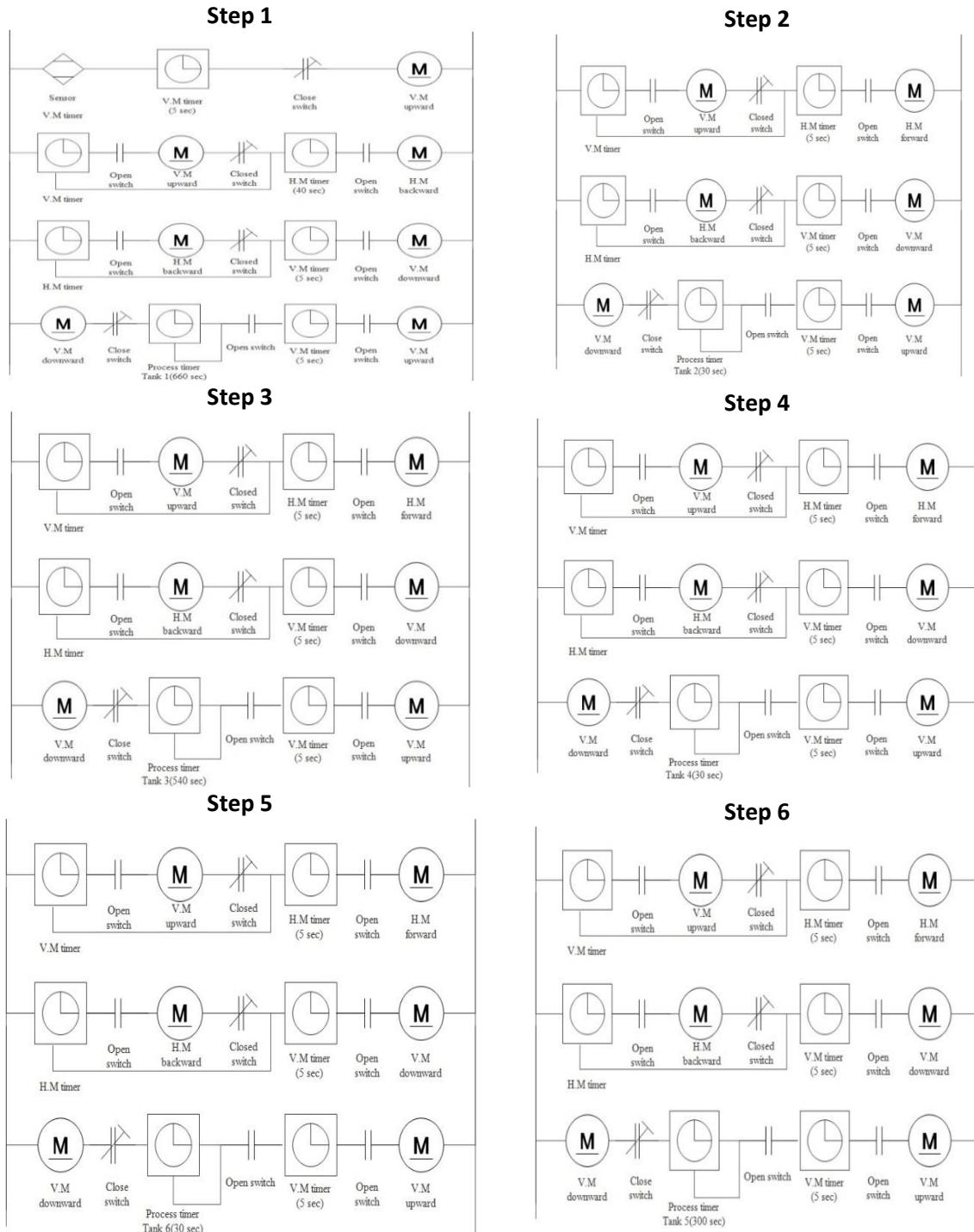
Step 12: These processes will be repeated for all the 7 tanks using timer for varying the time sequence.

Figure 12. Flow Chart

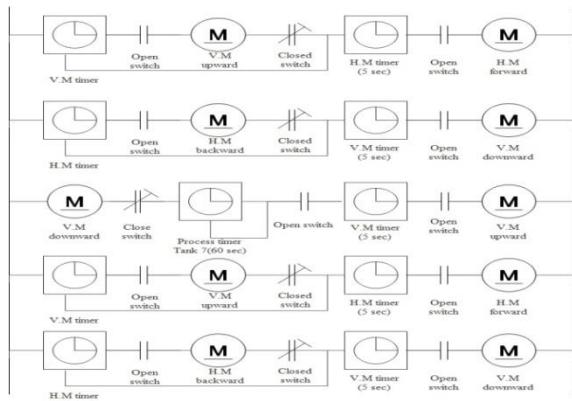


3.2 Relay Ladder Diagram

Figure 13. Relay Ladder Diagram



Step 7



The inductive proximity sensor can be placed inside the barrel to sense the metal rings. Manually load the 'O' rings into the barrel. It is approximately 13.5 kg because the conveyor moves with the limited weight. The metal rings can be sensed by the inductive proximity sensor.

A) The Horizontal BLDC motor can be connected at the conveyor roller for forward and backward direction and the vertical BLDC motor can be fitted with chain saw for control the upward and downward movement. It has torque of 0.15 Nm. The rated current is 3.2A the motor comes with gear box. When the Inductive proximity sensor senses the metal, the timer will be activated to rotate the vertical motor in upward direction for 5 sec. Subsequently the vertical motor stop then the timer will be activated to rotate the horizontal motor run in backward direction for 40 sec. After 40 sec the barrel will reach the TANK 1 and the timer will be active to rotate the vertical motor in downward for 5sec. In this step the process timer will be activated for 660 sec. There Alkaline degreasing process taking place.

B) After the alkaline degreasing process the vertical timer will be activate to lift the barrel in upward direction using vertical motor. Consequently the vertical motor stops then after 5 sec. The horizontal motor is activated to move in forward direction for 5 sec. After the conveyor reaches the TANK 2 following these horizontal motor stops and the timer will activate for vertical motor to move downward for 5 sec. Next the water rinsing process taking place for 30sec using timer. In that water rinsing is used between each process step at end of the process to remove all traces of chemical that remains on the surface. From the working principle of Second process the same process will be repeated for the remaining 5 process tanks. The Processing time will be varied for the each tank.

C) Process tank 3: The processing time for the process is 540 sec can be programmed in the timer.

D) Process tank 4: The water rinsing is used between each process step at end of the process to remove all traces of chemical that remains on the surface. The processing time for the process is 30 sec can be programmed in the timer.

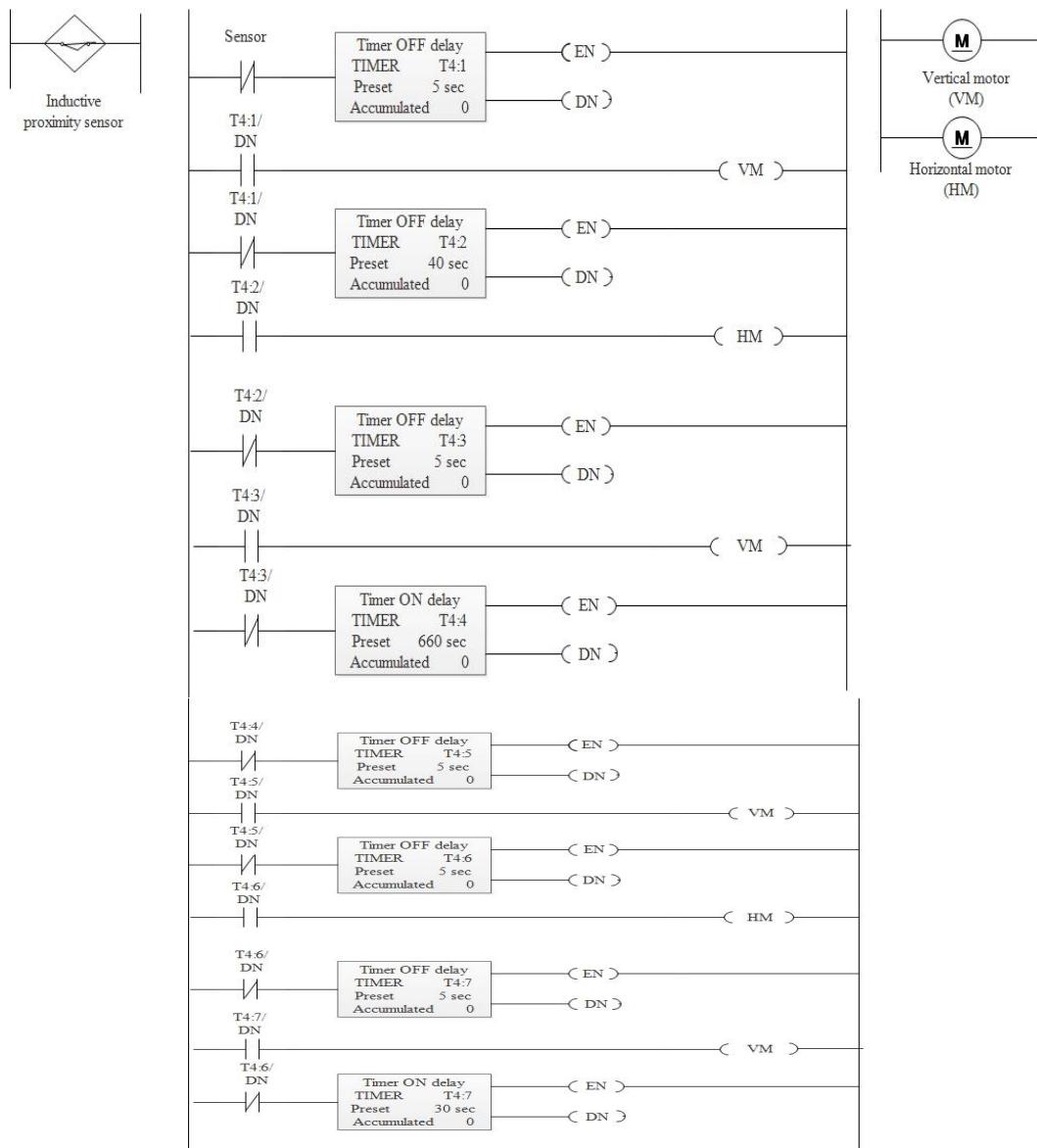
E) Process tank 5: The processing time for the process is 300 sec can be programmed in the timer.

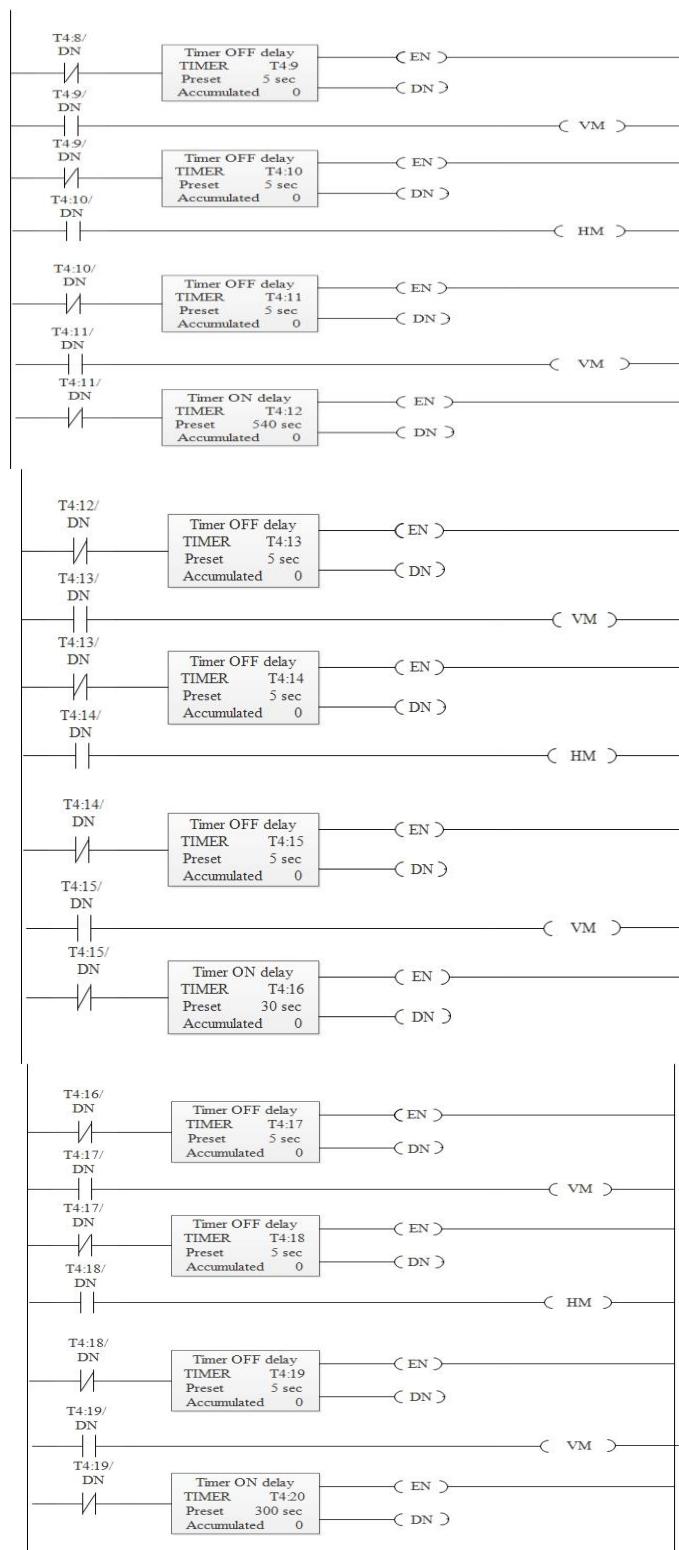
F) Process tank 6: The water rinsing is used between each process step at end of the process to remove all traces of chemical that remains on the surface. The processing time for the process is 30 sec can be programmed in the timer.

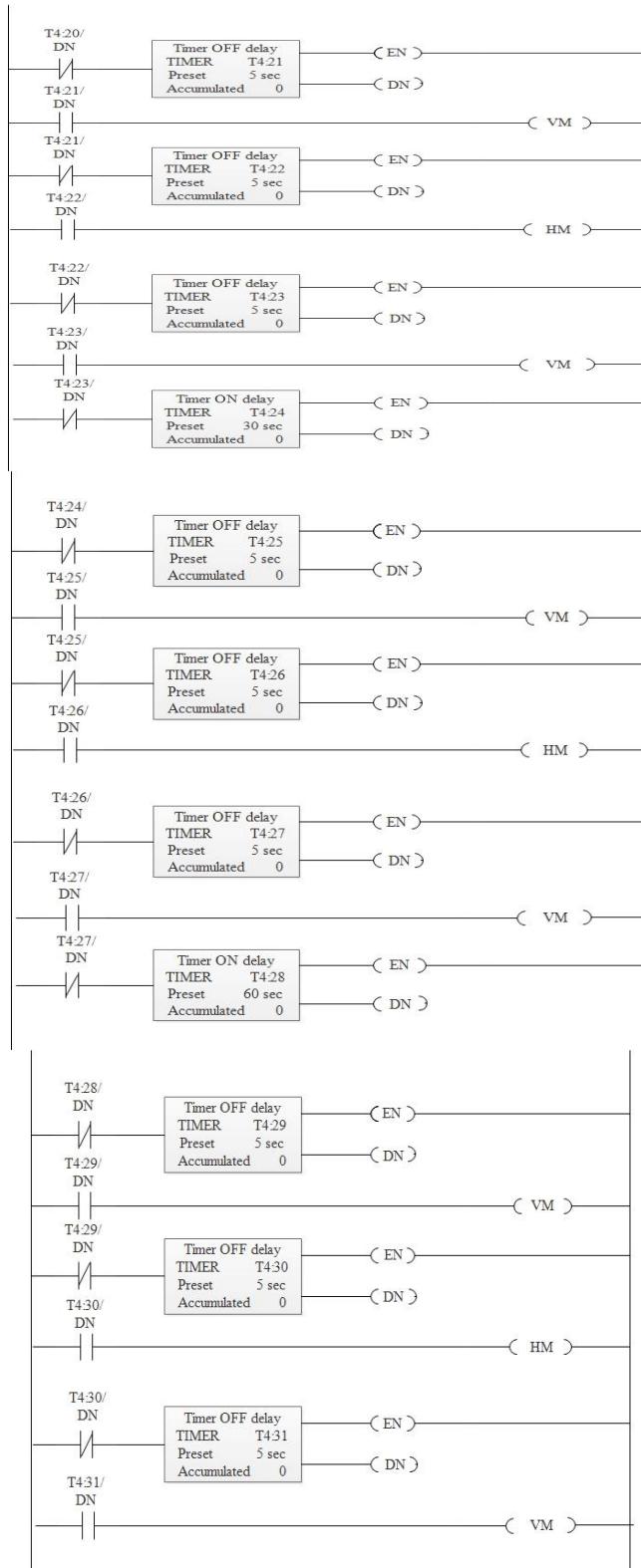
G) Process tank 7: The processing time for the process is 60 sec can be programmed in the timer (Shown in figure 13). At the end of the seven processes the conveyor moved to the starting place and the "O" rings can be unloaded

3.3 Ladder Diagram

Figure 13. Ladder Diagram







When the sensor is energized the contact will be closed. Closing the input switch SW immediately sets the tone bit of the timer T4:1 to 1, immediately turning ON the vertical motor. The preset value of the T4:1 is 5s. Now timer timing bit starts timing when the accumulator value reaches

the preset value done bit of T4:1 reset to zero and motor starter coil of VM de-energized. The normally closed contact of T4:1/DN energizes the done bit of timer T4:2 to 1, immediately turning ON the horizontal motor. The preset value of the T4:2 is 40 sec. Now the timer timing bit starts timing when the accumulator value reaches the preset value done bit of T4:2 reset zero and motor starter coil of HM de-energized. The normally closed contact of T4:2/DN energizes the done bit of timer T4:3 to 1, immediately turning ON the vertical motor. The preset value of the T4:3 are 5sec. Now timer timing bit starts timing when the accumulator value reaches the preset value done bit of T4:3 rest to zero and motor starter coil of VM de-energized. The normally closed contact of T4:3/DN energizes the enable bit of ON delay timerT4:4 and timer timing bits starts timing. The preset value of the timer is 660sec and the accumulator value reaches the preset value of T4:4 the done bit will be energized after 5 sec and the contact T4:5/DN closed to energize vertical motor starter coil. Normally closed conduct of T4:5/DN energized the done bit of timer T4:6 to 1, immediately turning ON horizontal motor. The preset value of the T4:6 are 5sec. Now timer timing bit starts timing when the accumulator value reaches the preset value done bit of T4:6 reset to zero and motor starts coil of HM de-energized. The normally closed contact of T4:6/DN energizes the done bit of timer T4:7 to 1 immediately turning ON vertical motor. The preset value of the T4:7 are 5sec. Now timer timing bit starts timing when the accumulator value reaches the preset value done bit of T4:7 rest to zero and motor starter coli of VM de-energized. The normally closed contact of T4:7/DN energizes the enable bit of ON delay timer T4:8 and timer bits starts timing. The preset value of the timer T4:8 is 30sec and the accumulator value reaches the preset value of timer T4:8 the done bit will be energized after 5sec contact and the T4:9/DN closed to energize vertical motor starter coil shown in Figure 13.

4. Conclusion

This projected automated arrangement exist implemented to overcome the disadvantage of the existent system. This plan gives extreme reliability, smooth to mechanically alter, easy to alter the series without changeful of the act of installing electric wires, reduces the fault happening, remove hardwiring, easy to watch carefully, smooth to find out the question take place in bureaucracy. So, bureaucracy improves the overall output and in addition to it reduces system account of finances or other business by way of using programmable science of reasoning boss (PLC). According to the results, automation method based on PLC happen favorably implemented for the fittings whole. It is very effective, littlest human errors and at first extreme cost whixh is surely overcome as per likely time. So, it happen well chosen for industrial cleansing process like seven phosphate method. This process is seconhand for cleansing the metals in hard work.

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