

PLC-Based 7-Tank System of Pre-Treatment Before Powder Coating

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Abstract: Powder coating is a finishing process in which dry, free flowing, thermoplastic or thermoset powder material is applied to a surface, melted, and hardened into an even coating. Pretreatment means surface preparation. Here by pretreatment, we mean metal pretreatment as the powder coating is predominantly applied to metals. Surface preparation includes: Cleaning – mechanical or chemical. Mechanical cleaning includes methods like scratch brushing and sand blasting. The process of pretreatment of a material is currently totally dependent upon manual labour and thus increases the cost of the project. By making the process automatic, the cost of the project can be substantially reduced. The conventional 7 tank process contains Degreasing, Derusting, Phosphating, Passivation and three water baths. The same process will be adopted in our process but instead PLC will be used to control and automate the entire project. The setup charges are considerable but it will be one time investment to the client.

Keywords: Powder coating, seven tank process

I. INTRODUCTION

In the conventional system of Pre-Treatment of Powder Coating, the Metal Job is loaded and unloaded into 7 tanks manually.

Hence, the time, efforts, recurring cost of Labours is on higher side if we compare it to one-time investment of the setup.

By using a PLC based fully Automatic 7 Tank Process System, we can achieve the following benefits,

- Reduces the possibility of human error
- Higher productivity
- Higher product quality
- Cost reduction
- Saves time
- High performance

Hence, taking a Realtime problem from current scenario and converting it into fully smart & autonomous process to achieve the benefits mentioned

above, is the main focus of selecting this topic for project.

II. LITERATURE REVIEW AND OBJECTIVE

A kind of durable powder coating without any solvent is a powder coating. It is commonly used in the metal industry because of its excellent application performance and ecofriendly usage. The use of powder coatings has been introduced very rapidly in recent years, and the criteria for practical powder coatings have also been continuously improved.

Pre-treatment prepares a component before powder coating is added to improve adhesion and corrosion resistance. Phosphating is a method of surface treatment by which the surface of virgin steel is converted into metallic phosphate and is commonly used before painting.

Post treatment increases resistance to corrosion and humidity about two to tenfold when compared to conversion coatings without final rinses. Posttreatments are usually chromic acid-based.

Advantages of control panel that is based on a PLC controller can be presented in few basic points: Compared to conventional process control system, number of wires needed for connections is reduced. Consumption is greatly reduced because a PLC consumes less than a bunch of relays.

Diagnostic functions of a PLC controller allow for fast and easy error detection. Change in operating sequence or application of a PLC controller to a different operating process can easily be accomplished by replacing a program through a console or using a PC software (not requiring changes in wiring, unless addition of some input or output device is required). It is cheaper compared to a conventional system, especially in cases where a large number of I/O instruments are needed and when operational functions are complex. Reliability of a

PLC is greater than that of an electromechanical relay or a timer.

III. MATERIALS AND METHODS

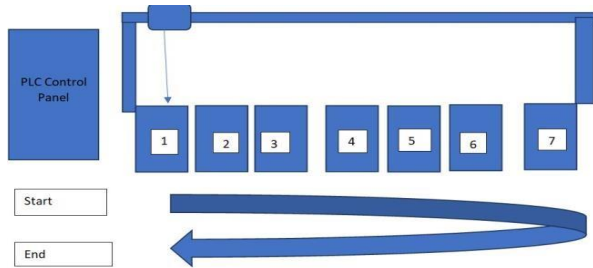


Fig. 1. Block diagram of the set-up

There will be a Gantry system (Vertical and Horizontal Motorized Slider) that will dip the loaded object to every Tank for predefined time.

The process of Dipping will be Serial & Time required for every Tank will be different. i.e., first the Object is loaded in Tank 1, the motor will slide to Tank 2, Then it will slide to Tank 3 and so on. The Gantry will be having a Motorized Gripper for Holding the object properly.

The Tanks are as follows

- Tank 1- Degreasing
- Tank 2 - Water Bath
- Tank 3- Derusting
- Tank 4- Water Bath
- Tank 5- Phosphating
- Tank 6- Water Bath
- Tank 7- Passivation

A. Operations via PLC

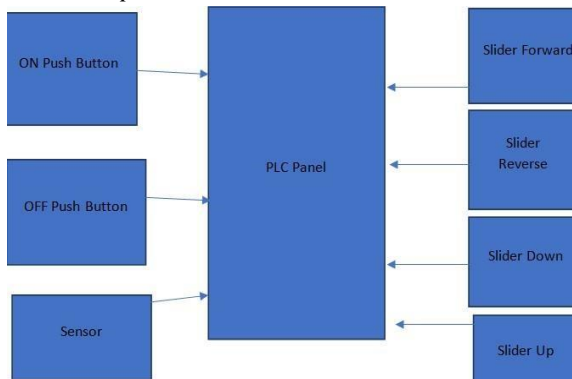


Fig. 2. Operations via PLC panel

The Programmable Logic Controller (PLC) will be programmed in such a way that it carries the entire process automatically. Just by the usage of two buttons (ON and OFF) the process can be initiated and ended.

Apart from these there will be other buttons with functions as follows- • Sensor- To sense the presence of Slider to return it back • Slider Up- To move Up vertically

- Slider Up- To move Up vertically
- Slider Down- To Move Slider downwards
- Slider left- Slider move left
- Slider Right- Slider move Right

IV.WORKING

PLC 7 tank system is a type of automation system that is used for them to live and monitoring multiple times in manufacturing or industrial environment the system typically consists of central plc which is connected to various sensors and actuators that are used for measuring and controlling their level temperature flow rate and other parameters of each tank the plc programmed used specialised software that allows the user to define the control logic and set 0.2 for each standard PVC resin for signal from sensors that installed these tank processes that attack adding to the define glory oncologist on the programming logic PC game seems doubtful to graduates used for country in the world from feathers and other utilities thank this allow the system to maintain desired level temperature flow rate in bank wide sensors get the entire process of recipe sentences make multiple times that use the word begin to united signatures against mixing return filing and storage PLC system can be customised to make the specification of each application and can live program can launch and allotment certain condition are met PC Chandra kitchen any practice solution for automating complex Mein picturein industrial processes and can help to improve productivity efficiency and safety in design element

V.SPECIFICATIONS OF ALL DEVICES-

- A) PLC (Programmable Logic Controller)
- PLC with an inbuilt HMI
 - Annunciator and PB Lamps
 - Customizable MIMIC
 - I/O Capacity- 48
 - Serial, Ethernet and MODBUS Connectivity
 - Analog IO



B) ON OFF Push Button-



- Power switches
- Snap-in type
- SDDJE series comes in SPST (Single Pole Single Throw) and DPST (Double Throw Single Pole) configuration
- SDDJE11200 is SPST ON-OFF Rocker Switch with IO marking.
- Operating temperature range $-10\text{ }^{\circ}\text{C}$ to $+55\text{ }^{\circ}\text{C}$
- Contact resistance $100\text{m}\Omega$ max.
- Insulation resistance $500\text{M}\Omega$ min. 500V DC
- Voltage proof $2,000\text{V}$ AC for 1minute
- Operating life 10,000cycles
- Actuator strength - Operating direction 25N
- Actuator strength - Perpendicular direction 25

VI.CONCLUSION

Thus, we searched for a Real time Problem in the Industrial Manufacturing Process. We checked the Feasibility of the Project along with the Components lists and technical stuff. We also implemented Mechatronics including Hardware & Software Programming which is in demand in current Industry. So, the system is completely built by using mechatronics and industrial technology that can automatically load and unload the industrial fabricated products in 7 tanks and get the Pretreatment process of Powder coating done thereby reducing the labour costs.

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