Internship Report

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Department:

Plant Maintenance (PM)

Contents

Preface

The University of Engineering and Technology, Lahore is one of the leading universities in the country. This institute renders invalid services to Pakistan by producing outstanding graduate Engineers who aim to change the world. I feel proud to be a part of that superb University and of our teachers because of their excellent style of teaching and vast knowledge, as well as their academic approach. Preparing students to face the world confidently and courageously, The University of Engineering and Technology, Lahore arranges internship Programs during summer vacations. The purpose of this program is to give practical exposure to our field of sub-study is also helpful for understanding the organizational environment and dealing with professionals. For that, I joined Hyundai Nishat Motors Private Limited, one of Pakistan's prestigious Automotive companies.

Acknowledgment

None, however great can lay claim to absolute originality in any branch of knowledge. No one can deny it. Everyone is indebted to their precursors in the particular field in which they are working. I am indebted to many individuals within my branch of knowledge and outside it. First, I am grateful to Almighty ALLAH, the most Beneficent and Merciful, who gave me the mind to think and all the physical abilities to work out problems and obstacles faced in life, and for giving me enough courage and commitment to complete this internship successfully. At Plant Maintenance department , I found people very cooperative. During the internship, I learned a lot and found it as an excellent learning place. I am very thankful to Mr Umar Ikram (PM), and Mr Ali Hassan (PM) and Mr Muhammad Faizan (PM) At this place, I would also like to be thankful to Mr. Irfan Younas (Manager of HR) for his guidance and warm support throughout the internship period.

CHAPTER# 1 Introduction To Industry

1.1 History:

Chung Ju-Yung founded the Hyundai Engineering and Construction Company in 1947. Hyundai Motor Company was later established in 1967, and the company's first model, the Cortina, was released in cooperation with Ford Motor Company in 1968. When Hyundai wanted to develop their own car, they hired George Turnbull in February 1974, the former managing director of Austin Morris at British Leyland. He in turn hired five other top British car engineers. They were body designer Kenneth Barnett, engineers John Simpson and Edward Chapman, John Crosthwaite, formerly of BRM, as chassis engineer and Peter Slater as chief development engineer. In 1975, the Pony, the first South Korean car, was released, with styling by Giorgio Giugiaro of Ital Design and powertrain technology provided by Japan's Mitsubishi Motors. Exports began in the following year to Ecuador and soon thereafter to the Benelux countries. Hyundai entered the British market in 1982, selling 2993 cars in their first year there.

Fig. 1.1 Hyundai Pony

In 1986, Hyundai began to sell cars in the United States, and the Excel was nominated as "Best Product #10" by Fortune magazine, largely because of its affordability. The company began to produce models with its own technology in 1988, beginning with the midsize Sonata. In the spring of 1990, aggregate production of Hyundai automobiles reached the four million marks. In 1991, the company succeeded in developing its first proprietary gasoline engine, the four-cylinder Alpha, and also its own transmission, thus paving the way for technological independence.

1.2 Company Overview:

Hyundai Motor Company is a South Korean multinational automotive manufacturer headquartered in Seoul, South Korea. Hyundai Motor Company was founded in 1967. Currently, the company owns 33.88 percent of Kia Corporation, and also fully owns two marques including its luxury cars subsidiary, Genesis Motor, and an electric vehicle subbrand, Ioniq. Those three brands altogether comprise the Hyundai Motor Group.

Hyundai operates the world's largest integrated automobile manufacturing facility in Ulsan, South Korea which has an annual production capacity of 1.6 million units. The company employs about 75,000 people worldwide. Hyundai vehicles are sold in 193 countries through

5,000 dealerships and showrooms. Hyundai has six research and development centers, located in South Korea (three offices), Germany, Japan and India. Additionally, a center in California develops designs for the United States.

Fig. 1.2 Headquarter in Seoul, South Korea

1.3 Hyundai Nishat:

Hyundai Nishat is a Pakistani automobile manufacturer and joint venture between Hyundai and Nishat Mills, based in Faisalabad, Pakistan. Hyundai Nishat is the authorized assembler and manufacturer of Hyundai vehicles in Pakistan and began production from its Faisalabad plant in 2019.

Fig. 1.3 Hyundai Nishat, Faisalabad

CHAPTER# 2 Hyundai Pakistan

2.1 History:

Hyundai returned to Pakistan in 2017 by partnering with Nishat Mills, a subsidiary of Nishat Group. Hyundai used to assemble cars in Pakistan until 2004, when their local partner Dewan Farooque Motors went bankrupt. Hyundai Nishat Motor signed an investment agreement with the Ministry of Industries and Production under the Automotive Development Policy 201621. The intent of the government is to shake up the Japanese-dominated car market and loosen the grip of Toyota, Honda and Suzuki, who assemble cars in Pakistan with local partners.

2.2 Overview:

Hyundai Nishat is a Pakistani automobile manufacturer and joint venture between Hyundai and Nishat Mills, based in Faisalabad, Pakistan. Hyundai Nishat is the authorized assembler and manufacturer of Hyundai vehicles in Pakistan. It was founded in 2017, 5 years ago and began production from its Faisalabad plant in 2019. Its headquarters is in Lahore, Pakistan. The CEO of Hyundai Nishat is Hassan Mansha. The industries Kia Lucky Motors, MG JW Automobile and Changan Automobile are also launching new models keeping competition alive for Hyundai.

Fig. 2.1 Hyundai, Pakistan

2.3 Vehicles:

The vehicle products of Hyundai in Pakistan are:

Locally Assembled:

- Hyundai Elantra (Sedan)
- Hyundai Sonata (Luxury sedan)
- Hyundai Tucson (Compact crossover SUV)
- Hyundai Porter H-100 (Light commercial vehicle/light truck)

Imported:

- Hyundai Staria (Minivan)
- Hyundai Santa Fe (Mid-size SUV)
- Hyundai Ioniq (Hybrid compact car)

Discontinued:

- Hyundai Santro (city car)
- Hyundai Shehzore (light truck)

2.4 Hyundai Elantra (AD):

It is a compact car produced by the South Korean manufacturer Hyundai since 1990. The Elantra was initially marketed as the Lantra in Australia and some European markets. In Australia, this was due to the similarly named Mitsubishi Magna Elante model; similarly, in other markets, the

name Avante is not used due to its similarity with Audi's "Avant" designation, which is used for their line-up of station wagons. The name was standardized as "Elantra" worldwide in 2001 (except in South Korea).

Hyundai launched Elantra in March 2021 in Pakistan. It's a C segment sedan that competes against Toyota Corolla Grande and Honda Civic. Elantra received a good response for a new entrant and soon became the favorite of many. From Jan 2022 to Feb 2022, sales of Hyundai Elantra increased by 186%. There are two variants in Pakistan:

- Hyundai Elantra GL (1600 cc, Automatic, Petrol) • Hyundai Elantra GLS (2000 cc, Automatic, Petrol)

Fig. 2.2 Hyundai Elantra

2.5 Hyundai Sonata (DN-8):

The Hyundai Sonata is a mid-size car that has been manufactured by Hyundai since 1985. The first-generation Sonata, which was introduced in 1985, was a facelifted Hyundai Stellar with an engine upgrade, and was withdrawn from the market in two years due to poor customer reaction. While the nameplate was originally only sold in South Korea, the second generation of 1988 was widely exported.

The eight generations of Sonata that were revealed at the Pakistan Auto Show held in 2020 by Hyundai Nishat have been launched in Pakistan. The latest Sonata in Pakistan has been powered by 2.5-liter engine. There are two variants in Pakistan:

- Hyundai Sonata 2.0 (2000 cc, Automatic, Petrol)
- Hyundai Sonata 2.5 (2500 cc, Automatic, Petrol)

Fig. 2.3 Hyundai Sonata

2.6 Hyundai Tucson (TL):

The Hyundai Tucson is a compact crossover SUV (C-segment) produced by the South Korean manufacturer Hyundai since 2004. In the brand's line-up, the Tucson is positioned below the Santa Fe, and above the Kona and Creta. It is named after the city of Tucson, Arizona. The second-generation model has been marketed as the Hyundai ix35 in several markets, including Europe, Australia and China, before reverting to Tucson for the third-generation. The Tucson is the best-selling Hyundai SUV model, with more than 7 million units sold globally since it launched in 2004. Of these.

Hyundai launched 3rd generation of Tucson in August, 2020 in Pakistan. It's a compact crossover SUV (C-segment) that competes against Toyota Fortuner and Kia Sportage in Pakistan. There are two variants in Pakistan:

- Hyundai Tucson FWD A/T GLS Sport (2000 cc, Automatic, Petrol)
- Hyundai Tucson AWD A/T Ultimate (2000 cc, Automatic, Petrol)

Fig. 2.4 Hyundai Tucson

2.7 Hyundai Porter (H-100):

The Hyundai Porter also known as the Hyundai H-100, is a cabover truck produced by the South Korean manufacturer Hyundai since 1977. In 2019 Hyundai Nishat Motors has launched its locally manufactured vehicle porter H-100 pickup for its customers in Pakistan.

- Hyundai H-100 2.6 MT (2607 cc, Manual, Diesel)

Fig. 2.5 Hyundai Porter (H-100)

CHAPTER# 3 Hyundai Nishat Motor (Faisalabad)

Overview:

Hyundai Nishat Motors is an automobile manufacturer located at Chak Jhumra, Faisalabad. Hyundai Nishat is the authorized assembler and manufacturer of Hyundai vehicles in Pakistan. It was founded in 2017, 5 years ago and began production in 2019. Its headquarters is located in Lahore, Pakistan. The CEO of Hyundai Nishat is Hassan Mansha.

Layout:

The layout of the Hyundai Nishat, Faisalabad is following:

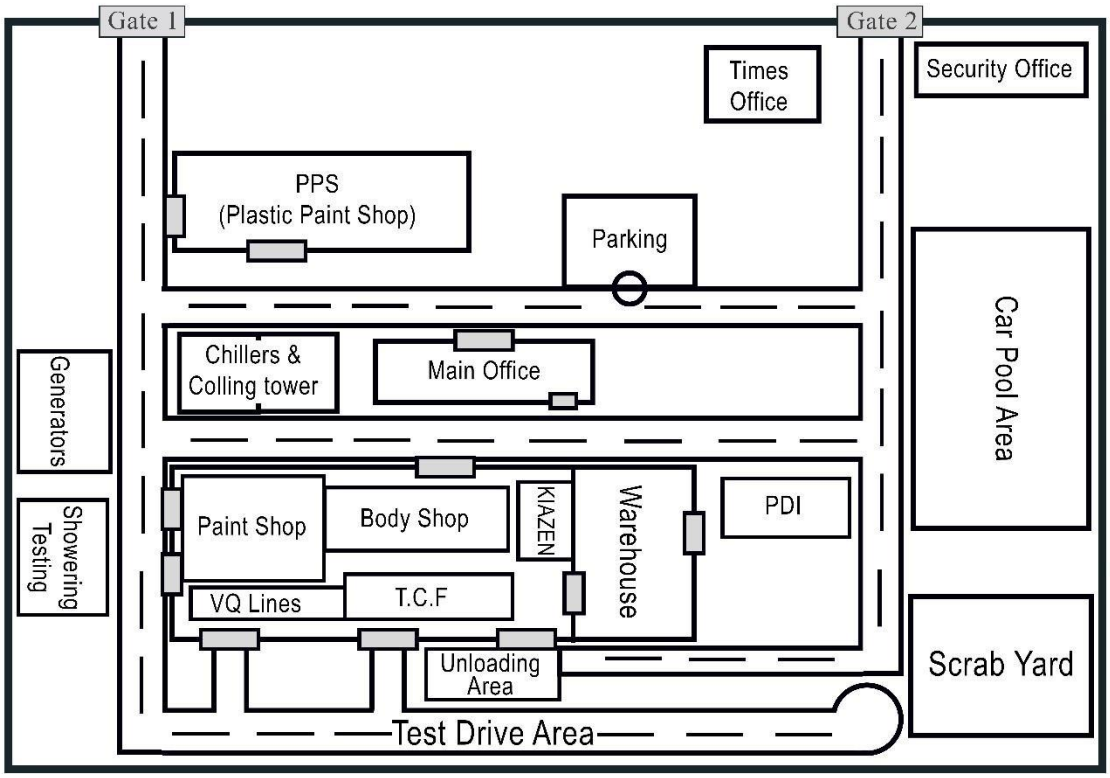


Fig. 3.1 Hyundai Nishat Layout

Departments:

There are many departments in Hyundai Nishat, Chak Jhumra, Faisalabad. Some of them are:

- PE&S (Production Engineering & Support) Department
- Body Shop Department
- Paint Shop Department
- Admin Department
- HR (Human Resources) Department

- IT (Information Technology) Department
- QC (Quality Department) Department
- T.C.F (Trim Chassis Final) Department
- PPS (Plastic Paint Shop) Department
- MEP (Mechanical Electrical Plumbing) Department
- Finance Department
- Civil Department
- PPMC (Production Planning and Material Control) Department
- PM (Plant Maintenance) Department
- HSE (Health Safety and Environment) Department
- PVD (Purchase and vender development) Department, etc.

Every department has its own duty to perform. I was in PE&S department. It deals with the production of the plant. We have to ensure that the production is going smoothly and making efforts to increase the production by doing KIAZEN. Every development in the plant for the betterment of the production was done by the PE&S department. It basically directly deals with the production of plant.

Shops & Areas:

The assembling shops and the important areas of the Hyundai Nishat plant are as following:

Areas:

- Unloading Area.
- Warehouse.
- Unboxing Area.
- PQ (Parts Quality).
- Car Pool Area.
- Car Loading Area.
- Scrap Yard.
- KIAZEN Area.

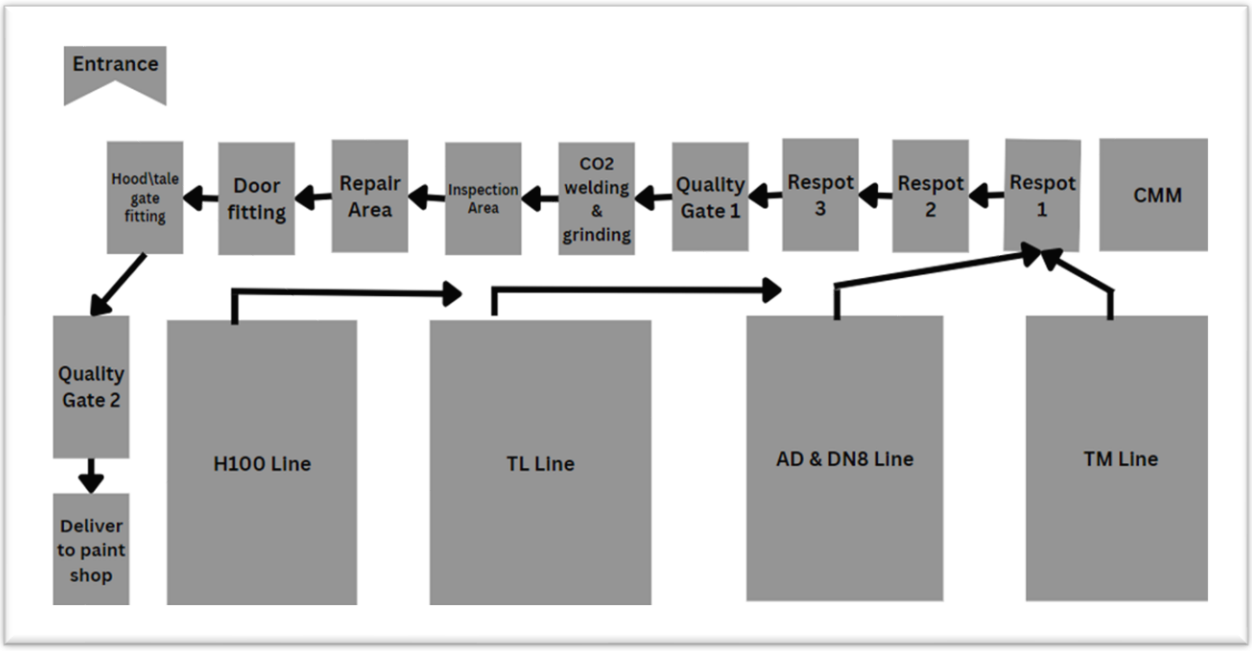
Shops:

- Body Shop.
- Paint Shop.
- PPS (Plastic Paint Shop).
- TCF (Trim Chassis Final).
- VQ (Vehicle Quality)
- PDI (Pre-Delivery Inspection).

Every shop and area have its own specific purpose. There are different processes to assemble a car. Every shop performs its own job and then a car reached its final form.

BODY SHOP

HNMPL's body shop is the first stage of manufacture. Through spot welding and CO2 welding, the parts are combined to form the car's structure. The layout of the body shop is as follows:



The body shop in the automobile industry represents a crucial stage where manual work is performed. This section is dedicated to the assembly, repair, and customization of vehicle bodies. Skilled technicians and craftsmen work meticulously to weld, shape, and fit various body components, ensuring structural integrity and aesthetic appeal. From cutting and bending metal sheets to installing doors, hoods, and fenders, the body shop's workforce employs their expertise to create durable and visually appealing car bodies.

Major Processes Performed in Body Shop

Spot Welding:

In HNMPL Body shop, Spot welding or also known as resistance welding is done to join metal sheets. Spot Welding is a type of resistance welding process used to join two or more metal sheets together by applying heat and pressure to localized points on their surfaces. It is a commonly used technique in various industries, including the automobile industry. The spot welding process typically involves the following steps:

1) **Preparation:**

Before spot welding, the metal sheets to be joined are thoroughly cleaned to remove any surface contaminants that could interfere with the welding process.

2) **Electrode placement:**

Two copper alloy electrodes, one on top and one on the bottom, are positioned on either side of the metal sheets, ensuring that the electrodes make direct contact with the material.

3) **Application of pressure:**

The electrodes are then pressed together with a predetermined force to hold the metal sheets securely in place during the welding process.

4) **Application of current:**

A high electrical current is passed through the electrodes and into the metal sheets. The resistance of the metal to the electrical current generates heat at the points of contact between the sheets.

5) **Melting and bonding:**

The heat generated by the electrical current causes the metal at the contact points to melt. As the current is applied for a specific amount of time, the molten metal fuses together, forming a strong weld joint.

6) **Cooling:**

After the welding time is completed, the electrical current is stopped, and the electrodes are held in place for a short period to allow the weld to cool and solidify.

Spot Welding Guns:

In the automobile industry, spot guns, also known as spot welders, play a crucial role in the manufacturing and assembly processes. These specialized welding tools are employed to join metal components together by creating a series of small, localized welds, or spots along the joint. Spot guns utilize electrical resistance to generate the necessary heat for welding, effectively melting the metal surfaces and fusing them together. **There are two types of guns are used in automobile industry:**

1) X-Type Spot Gun:

The X type spot welding gun boasts enhanced electrode control and force distribution, ensuring consistent and uniform welds across various automotive components, such as body panels, chassis,

and structural parts. Its ergonomic design and user-friendly interface have also increased worker productivity and reduced operator fatigue. Moreover, the gun's ability to adapt to different material thicknesses and types, including high-strength steels and aluminium alloys, has made it an essential asset in the production of modern vehicles, promoting safety, durability, and overall performance

2) C-Type Spot Gun:

The C-type configuration allows for easy access to tight spaces, making it ideal for welding intricate parts and challenging joint geometries found in automotive bodies. With their ability to deliver high currents and quick welding cycles, C-type spot welding guns enhance productivity while maintaining consistent weld quality, thereby contributing significantly to the production of safe and reliable automobiles

CO2 Welding:

CO2 welding, also known as Gas Metal Arc Welding (GMAW), is a widely used welding process in the automobile industry. It plays a crucial role in the fabrication and assembly of automotive components due to its versatility, speed, and cost effectiveness.

Key Features and Benefits Of CO2 Welding

1) Versatility:

CO2 welding can be employed to join a wide range of metals commonly used in the automotive industry, including steel, aluminium, and stainless steel. This adaptability allows manufacturers to use the most appropriate materials for various components, leading to lightweight and durable vehicles.

2) High Welding Speed:

The continuous electrode wire used in CO2 welding enables high welding speeds, making it suitable for mass production in the automobile industry. The increased productivity results in quicker assembly of components and faster vehicle production.

3) Cost-effectiveness:

Compared to other welding methods, CO2 welding is relatively economical. The process minimizes the need for skilled labor, reduces welding time, and lowers overall production costs, making it an attractive choice for automobile manufacturers.

4) Weld Quality: CO2 welding produces high-quality welds with excellent strength and structural integrity. This is crucial for ensuring the safety and reliability of automobile components subjected to various stresses during the vehicle's lifetime.

5) Semi-automated and Automated Welding:

CO2 welding can be easily integrated into automated production lines. Automated welding systems enhance precision, consistency, and repeatability, contributing to higher-quality welds and streamlined manufacturing processes.

Sealers:

- Sealers are specialized materials used to fill gaps and joints between automotive components, ensuring a tight and secure fit.
- They help prevent water, dust, and other contaminants from entering critical areas of the vehicle, such as the engine bay and interior compartments.
- Sealers enhance the structural integrity of automotive body panels by providing an additional layer of protection against corrosion and rust
- In automotive manufacturing, sealers play a crucial role in creating airtight and weather-resistant seals in doors, windows, and other openings
- They contribute to sound dampening, reducing noise and vibration inside the vehicle cabin, leading to improved comfort for occupants.
- Sealers are also used during the assembly of vehicle components, aiding in the bonding of materials like metal, plastic, and glass.

Types of sealers used in Hyundai:

- Spot Type Sealer (used for HR only)
- D-Type Sealer (used for TL, AD and DN8)
- Mastic Sealer (used for AD and HR)

Paint Shop:

The paint shop is used to paint the body. The car is loaded into the paint shop from the metal finishing line. Then there are 11 tanks of pre-Degreasing, Degreasing, etc. Which are used to applied the ED coat to the car. Then there is ED oven which bake the car for 30 min. Then car moves towards the sealer area. In the sealer area the sealer is applied to the car, after that it is baked in to the sealer oven. After that car moves towards the primer booth. In primer booth the primer coat is applied to the car. Then it moves towards the primer oven, afterwards it moves towards the top coat. After applying top coat and top oven. Then there is wax area and final touch up area. After applying final touch up and wax then the car is delivered to the TCF line.

Process:

The process of the paint shop is defined in the following:

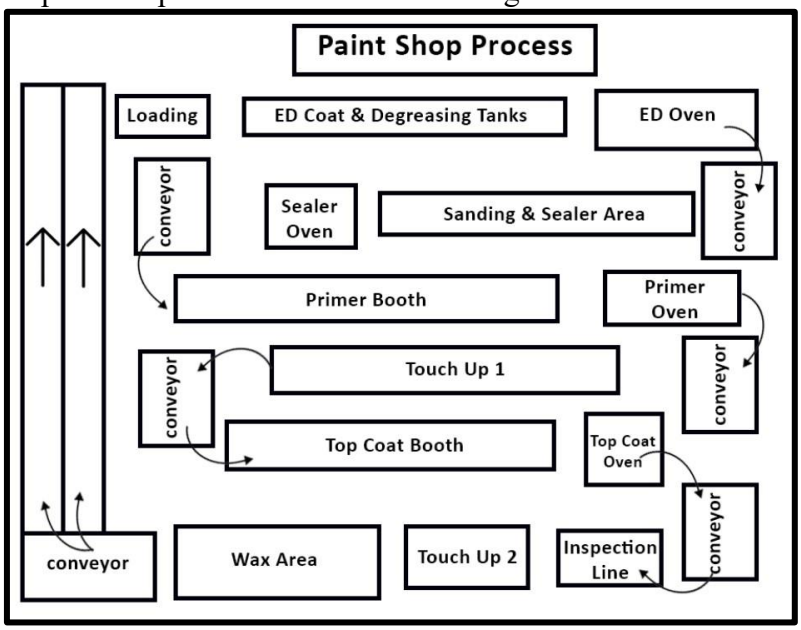


Fig. 5.2 Paint Shop

ED Coat & Tanks:

There are 11 tanks used to clean the metal body of car and to apply ED coat:

1. Pre-Degreasing Tank
2. Degreasing Tank
3. Water Rinse 01 Tank
4. Surface Conditioning Tank
5. Phosphate Tank
6. Water Rinse 02 Tank
7. DI (Deionized Water) Rinse Tank
8. E-Coat Tank
9. UF Rinse 01 Tank
10. UF Rinse 02 Tank
11. DI (Deionized) water Rinse Tank

Every tank has its own ability and duty. A metal body car is dipped in these 11 tanks to clean its body and apply ED coat on the car.

Sealer Area:

Different types of sealer are applied to the car in the sealer area. Underbody sealer is also applied to the car. Then the body is baked in the sealer oven for 15 min and at 145°C. These sealers are

used to stop leakage, reduce the vibration and avoid the rust on car. In under coat RPP (Rocker Pannal Primer) and Masking is applied.

ASH-System:

ASH (Air System Handling) is used to control the temperature and humidity in the paint booth. There are 6 units in the ASH system:

- Unit# 1: Air Supply
- Unit# 2: Heating Coil
- Unit# 3: Cooling Coil
- Unit# 4: Water Showering
- Unit# 5: Filters
- Unit# 6: Burner (Gas Train)

Defects of Paint Shop:

The defects occur during the paint shop are:

- Sag in Paint
- Fiber in Paint
- Dust Particle in Paint

Important Points of Paint Shop:

The important points of Paint shop are:

- The paint shop starts with the wiping of car with Naphthalene.
- There are 11 tanks for ED coat.
- ASH-System is used to control the temperature and humidity in the Paint booth.
- There are 4 ovens in the Paint shop.
- ED oven has capacity of 4 cars at a time.
- The tech time for ED oven is 30 min.
- The temperature of ED oven is 180 ºC.
- The tech time for sealer oven is 15 min.
- The capacity of sealer oven is 2 cars at a time.
- The tech time for primer oven is 30 min.
- The tech time for top coat oven is 30 min.

TCF (Trim Chasis Final)

Introduction

The Total Chassis Finishing (TCF) department plays a crucial role in ensuring the efficient and precise assembly of automotive chassis and final vehicle components. This report outlines the key elements under plant maintenance in the TCF department, focusing on the automated hanger system, the PRR 3 DOF manual manipulator, and the John Bean wheel alignment equipment.

Automated Hanger System

Description

The TCF department utilizes an automated hanger system designed to transport the vehicle body from chassis sub-assemblies. This system is critical for maintaining the flow of production and ensuring that the chassis and body alignment are accurately managed.

Components and Functionality

- **PLC Automation**: The hanger system is automated using a Programmable Logic Controller (PLC), which controls the movement and coordination of the hanger.
- **Remote Operation**: While the hanger itself is automated, the mounting of the car body is performed manually using a remote control. This allows for precise placement and adjustments as needed.

Maintenance Requirements

- **Regular Software Updates**: Ensuring the PLC system is updated to the latest software version to avoid operational glitches.
- **Remote Control Inspection**: Regular checks on the remote control functionality to prevent delays due to remote failure.
- **Mechanical Checks**: Routine inspection of the hanger's mechanical parts to detect and address wear and tear.

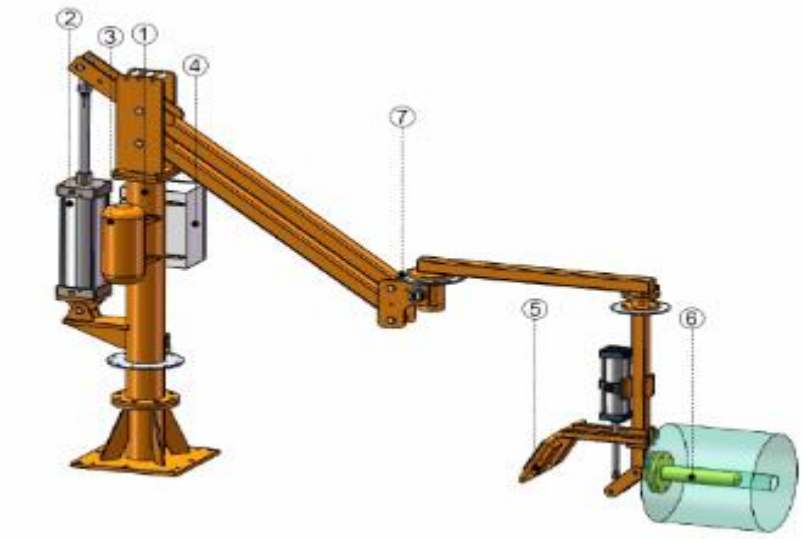
PRR 3 DOF Manual Manipulator

Description

In the final assembly section, a PRR 3 Degrees of Freedom (DOF) manual manipulator is employed for various processes, with its primary application in the tyre fitting section.

Components and Functionality

- **Double-Acting Cylinders**: The manipulator is equipped with double-acting cylinders that provide controlled motion and force in multiple directions.
- **Manual Operation**: While the cylinders are automated, the overall system requires manual operation, allowing for precise handling and assembly of components.



Maintenance Requirements

- **Cylinder Maintenance**: Regular lubrication and inspection of the double-acting cylinders to ensure smooth operation.
- **Manual Control Checks**: Ensuring the manual controls are responsive and accurate to prevent mishandling.
- **Component Replacement**: Timely replacement of worn-out parts to maintain efficiency and safety.

John Bean Wheel Alignment Equipment

Description

The John Bean wheel alignment system is a critical tool in the TCF department, used to ensure accurate wheel alignment, which is vital for vehicle safety and performance.

Components and Functionality

- **Alignment Sensors**: Equipped with precise sensors to measure the alignment angles of the wheels.
- **User Interface**: A user-friendly interface for technicians to input data and monitor alignment adjustments.

Maintenance Requirements

- **Sensor Calibration**: Regular calibration of the alignment sensors to maintain measurement accuracy.
- **Software Maintenance**: Updating the software to include the latest alignment protocols and vehicle specifications.
- **Physical Inspection**: Checking for any physical damage or misalignment in the equipment itself.

Conclusion

Maintaining the equipment in the TCF department is essential for ensuring efficient and accurate vehicle assembly. The automated hanger system, PRR 3 DOF manual manipulator, and John Bean wheel alignment equipment each play critical roles in this process. Regular maintenance, including software updates, mechanical inspections, and component replacements, is necessary to keep these systems operational and reliable.

By adhering to these maintenance protocols, the TCF department can continue to meet its production goals while ensuring the quality and safety of the assembled vehicles.

Maintenance Processes in the Quality Control Department

Introduction

The Quality Control (QC) department is essential for ensuring that all vehicles meet the highest standards of safety, performance, and reliability. This report outlines the main maintenance processes within the QC department, focusing on brake test inspection, roll and speed test, and the maintenance of Advanced Driver Assistance Systems (ADAS).

Brake Test Inspection

Description

The brake test inspection process is designed to ensure that the vehicle's brake systems function correctly under a variety of conditions. This is crucial for vehicle safety and performance.

Components and Functionality

- **Dynamic Testing Equipment**: Utilized to simulate different driving conditions and measure brake performance.
- **Data Logging Systems**: Records the performance data for analysis and quality assurance.

Maintenance Requirements

- **Calibration of Testing Equipment**: Regular calibration to ensure accuracy in measurements and simulations.
- **Inspection of Sensors and Components**: Routine checks for wear and tear or malfunctioning parts.
- **Software Updates**: Ensuring that the testing software is up-to-date with the latest standards and protocols.

Roll and Speed Test

Description

The roll and speed test verifies the stability of the vehicle and the accuracy of the speedometer. This process is vital for confirming that vehicles perform correctly at different speeds and conditions.

Components and Functionality

- **Rolling Road (Dynamometer)**: Simulates driving conditions to measure vehicle stability and speed.
- **Speed Sensors**: Accurate sensors that measure and verify the speedometer readings.

Maintenance Requirements

- **Rolling Road Maintenance**: Regular inspection and maintenance of the dynamometer to ensure smooth operation.
- **Sensor Calibration**: Periodic calibration of speed sensors to maintain accuracy.
- **Software and Firmware Updates**: Keeping the testing system's software and firmware current to ensure reliable performance.

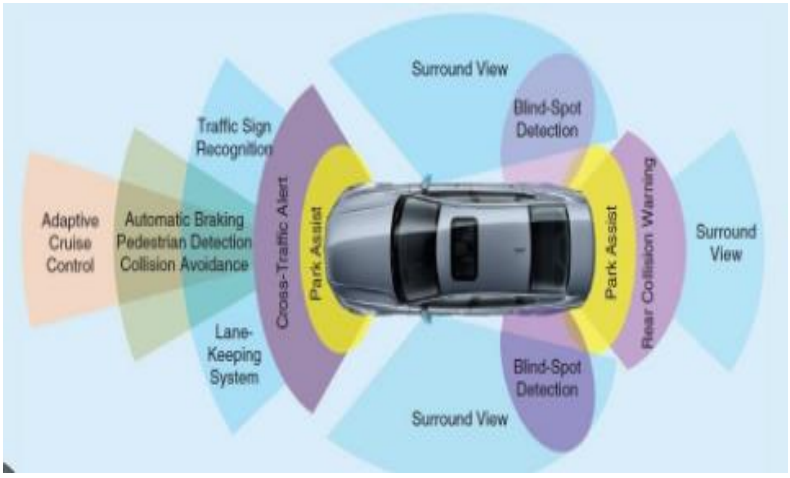
Advanced Driver Assistance Systems (ADAS)

Description

ADAS maintenance checks the functionality and reliability of driver assistance technologies, which are integral for modern vehicle safety and convenience.

Components and Functionality

- **Sensor Systems**: Includes cameras, radar, lidar, and ultrasonic sensors used in various ADAS functions.
- **Control Modules**: The electronic control units (ECUs) that process sensor data and control ADAS functions.



Maintenance Requirements

- **Sensor Alignment and Calibration**: Regular calibration and alignment to ensure sensors provide accurate data.
- **Software Updates**: Ensuring the ADAS software is up-to-date with the latest enhancements and bug fixes.
- **Diagnostic Checks**: Running diagnostic tests to identify and address any potential issues with the ADAS components.

Conclusion

The Quality Control department plays a crucial role in maintaining vehicle safety and performance standards. The brake test inspection, roll and speed test, and ADAS maintenance processes are fundamental to this effort. Regular maintenance, including calibration, inspection, and software updates, is essential to ensure these systems operate effectively and reliably.

By adhering to these maintenance protocols, the QC department can ensure that every vehicle meets the highest quality standards before leaving the production line, thus guaranteeing customer safety and satisfaction.

Training Sessions

I have attended two training sessions in my internship tenure:

8.1 Training Session 1:

The first training session was on the Lean Process. In the Lean process there are terms 3M and

3M:

3M is abnormalities in work. It is a Japanese term:

- MUDA (Waste/ Non-valued)
- MURI (Over Burden)
- MURA (Fluctuation)

FU:

FU refers to 6 abnormalities in work. It is also a Japanese term:

- Fu-ryou (Defect)
- Fu-chou (Disorder)
- Fu-you (Unwanted)
- Fu-antei (Unstable)
- Fu-kai (Unpleasant)
- Fu-kanou (Impossible)

8.2 Training Session 2:

The second training session was on the topic “Creative Suggestion System”. It was basically the explanation of KIAZEN area and the importance of KIAZEN area.

KIAZEN:

KIAZEN is a Japanese term which means continue search for betterment. After the world war-II, Toyota first implement the KIAZEN area for the development. In 1950s it become more popular in Japanese industries. It basically deals with PDCA (Plan Do Check Act). It is the development area of the industry where every type of development can be made. There are 8-steps to KIAZEN:

1. Clarify Problem
2. Break down Problem
3. Target Setting
4. Root Cause Analysis
5. Development Counter Measure
6. Implement counter Measure
7. Monitor Process & Results

8. Standardized & Generalized

Objective:

The objective of KIAZEN is to:

- Individual Improvement of workers.
- Positive and satisfied work place.
- Contribution in company growth.

Benefits:

The benefits of KIAZEN are:

- Safety
- Quality
- Productivity
- Cost
- HR&D (Human Resources and Development)

Lean Manufacturing:

Lean manufacturing is a production philosophy that emphasizes maximizing value for the customer while minimizing waste. Originating from the Toyota Production System (TPS), lean manufacturing aims to enhance efficiency, improve product quality, and reduce costs by streamlining production processes and eliminating non-value-added activities. Here are the core principles and common practices associated with lean manufacturing:

Core Principles

Value: Define value from the customer's perspective. This means identifying what the customer is willing to pay for.

Value Stream: Map out all the steps in the value stream for each product family, identifying and eliminating waste.

Flow: Ensure that the production process flows smoothly and continuously without interruptions.

Pull: Implement a pull system where production is based on customer demand rather than forecasting.

Perfection: Strive for continuous improvement (kaizen) by constantly seeking ways to reduce waste and improve processes.

Common Practices

5S System: Organize the workplace into five phases: Sort, Set in order, Shine, Standardize, and Sustain. This system helps maintain an organized, efficient, and safe work environment.

Kanban: Use visual signals to control the flow of materials and information, ensuring that inventory levels match actual consumption.

Kaizen: Implement continuous improvement practices involving all employees to identify and eliminate waste.

Jidoka (Autonomation): Empower machines and workers to detect and stop production when a defect is found, preventing defective products from continuing through the process.

Just-In-Time (JIT): Produce only what is needed, when it is needed, and in the amount needed, minimizing inventory and reducing lead times.

Value Stream Mapping (VSM): Create a visual representation of the entire production process to identify and eliminate waste.

Types of Waste (Muda)

Lean manufacturing identifies seven types of waste to eliminate:

Overproduction: Producing more than what is needed or before it is needed.

Waiting: Idle time when resources are not in use.

Transport: Unnecessary movement of materials or products.

Extra Processing: Performing more work or higher quality than required by the customer.

Inventory: Excess products or materials not being processed.

Motion: Unnecessary movements by people.

Defects: Production of defective parts or products requiring rework or scrap.

By focusing on these principles and practices, lean manufacturing aims to create a more efficient, responsive, and customer-focused production system.

Assignment: 01 Working of Spot Welding Gun

Introduction

The purpose of this report is to explain the components and working principles of a Spot Welding Gun (SWG), as illustrated in the provided schematic diagram. Spot welding is a type of resistance welding used to join two or more metal sheets together by applying pressure and heat from an electric current to the weld area. This process is widely used in the automotive and manufacturing industries due to its efficiency and speed.

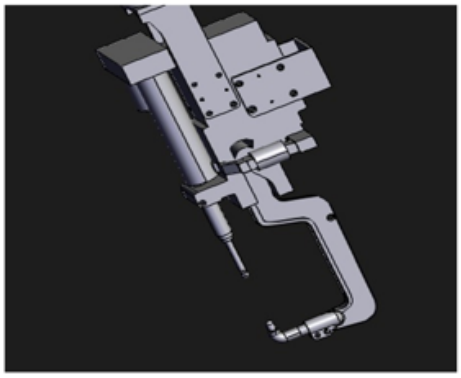
Components of the Spot Welding Gun

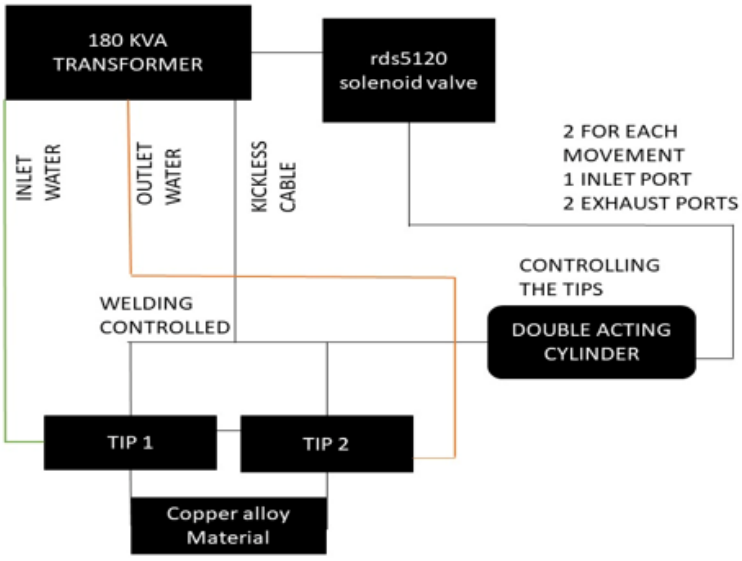
1. **180 KVA Transformer:**
   - This transformer is responsible for converting high voltage, low current input into low voltage, high current output necessary for the welding process. The high current is crucial for generating the heat needed to melt the metal at the welding spot.
2. **rds5120 Solenoid Valve:**
   - The solenoid valve controls the flow of air or fluid necessary for the operation of the welding gun. It has one inlet port and two exhaust ports, allowing it to manage the double-acting cylinder's movement.
3. **Double Acting Cylinder:**
   - This component controls the movement of the welding tips. It operates under the control of the solenoid valve and is essential for applying the necessary pressure to the workpieces being welded.
4. **KICKLESS Cable:**
   - A kickless cable is used to transmit the electrical current from the transformer to the welding tips without causing electrical noise or interference. This helps in maintaining a stable and consistent welding process.
5. **Inlet Water and Outlet Water:**
   - These channels are used for cooling purposes. Water is circulated through the welding gun to prevent overheating and ensure the equipment operates within safe temperature ranges.
6. **Welding Controlled Tips (Tip 1 and Tip 2):**
   - These are the contact points where the welding current is applied to the workpieces. They are made of copper alloy material, which is highly conductive and durable, ensuring efficient heat transfer and long service life.
7. **Copper Alloy Material:**
   - The tips are made of copper alloy material, which is essential for its conductivity and ability to withstand the high temperatures generated during the welding process.

Working Principle of the Spot Welding Gun

1. **Preparation:**
   - The metal sheets to be welded are placed between the welding tips (Tip 1 and Tip 2). The double-acting cylinder ensures the tips are properly aligned and apply the necessary pressure to hold the sheets in place.
2. **Current Application:**
   - Once the metal sheets are secured, the transformer supplies a high current to the welding tips through the kickless cable. This high current generates intense heat at the contact point, causing the metal sheets to melt and fuse together.
3. **Cooling:**
   - During the welding process, the inlet and outlet water channels ensure that the welding gun remains cool. The cooling system prevents overheating, which could damage the equipment or affect the quality of the weld.
4. **Completion:**
   - After the desired welding time, the current is stopped, and the welded spot is allowed to cool down and solidify. The double-acting cylinder then releases the pressure, and the welded workpieces can be removed.

Schematic Diagram:





Conclusion

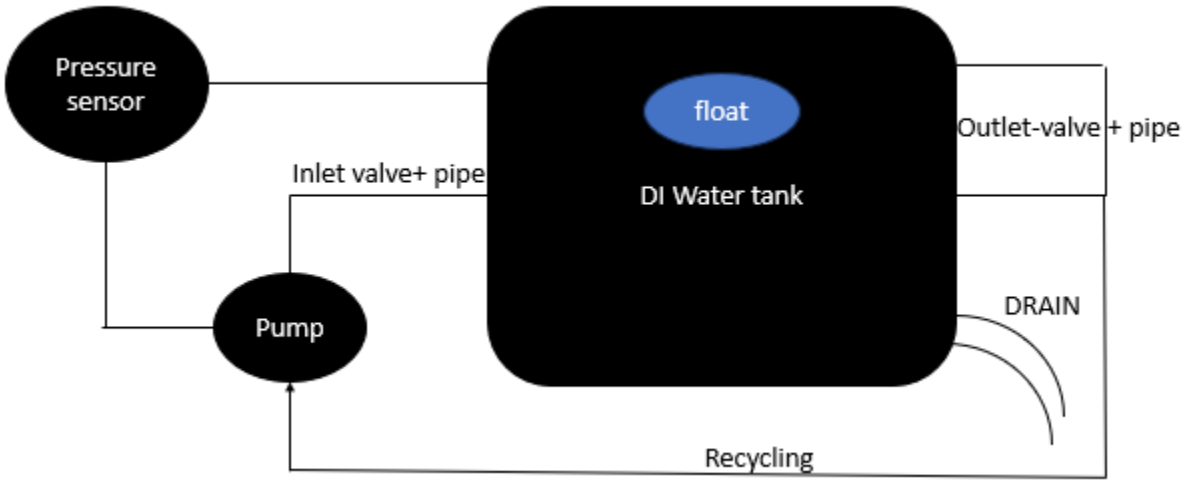
The schematic of the Spot Welding Gun provides a clear overview of the components and their functions in the welding process. By understanding the role of each part, we can appreciate the complexity and precision required to achieve effective spot welding. This technology plays a crucial role in various industries, making it essential to understand its working principles for efficient and safe operation.

Project: Temperature Control of the Phosphate Pump's Mechanical Seal Water Tank

Introduction

The temperature control of the phosphate pump's mechanical seal water tank is crucial for maintaining the efficiency and longevity of the pump. The mechanical seal of the pump heats up quickly and requires constant lubrication and cooling to function at its maximum potential and avoid breakdowns. This report outlines various solutions for controlling the temperature of the water tank, analyzes each solution, and compares them to determine the best approach.

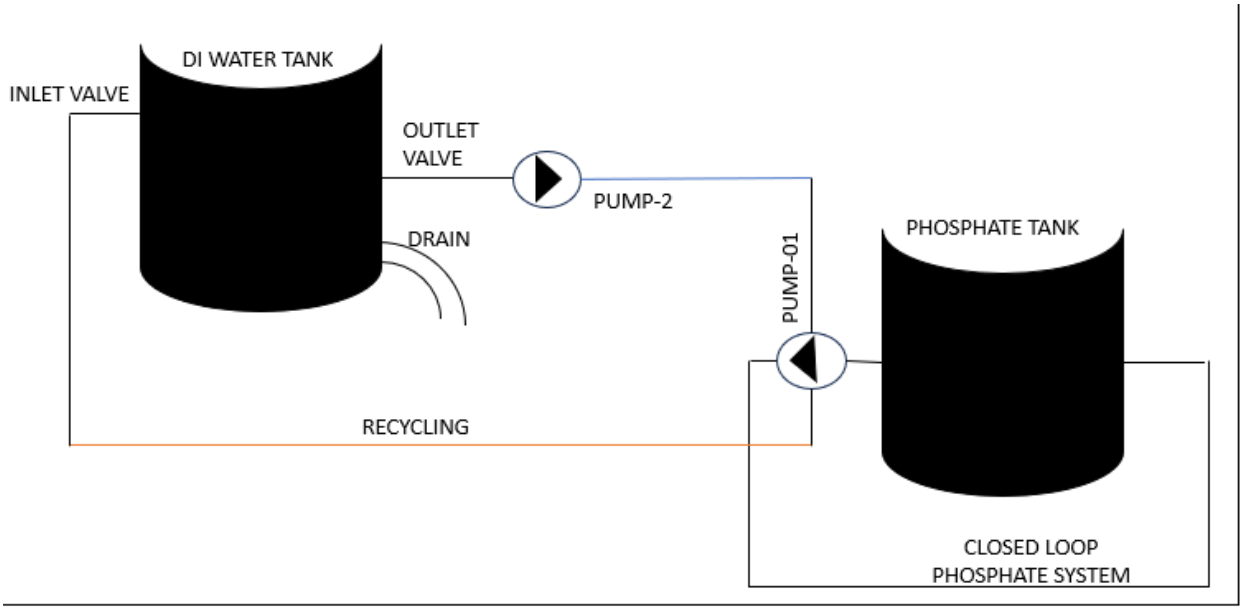
Schematic of water tank:



Problem Statement

The primary challenge is to maintain the temperature of the water tank below a certain limit (42 degrees Celsius) to ensure the cooling and lubrication of the mechanical seal. The current manual system, where a worker periodically checks the temperature and adjusts the valves, is inefficient and prone to human error.

Schematic Diagram of the process:



Proposed Solutions

Solution 1: PLC-Based Temperature Control

1. **Components:**
   - Temperature sensor (PT100 or thermocouple) for temperature measurement.
   - Two solenoid valves for inlet and outlet flow control.
   - Temperature module attached to the PLC in the paint shop.
2. **Working:**
   - When the temperature exceeds 46 degrees Celsius, the temperature sensor sends a signal to the module to turn on the inlet and outlet valves.
   - The valves remain open until the temperature drops to 42 degrees Celsius, at which point the sensor signals the PLC to close both valves.
   - Testing shows it takes 25-40 seconds for the water temperature to drop from 46 degrees to 42 degrees Celsius.

Solution 2: Using a Gas Circulation System

1. **Components:**
   - Insulation material for the tank.
   - Heat exchangers submerged in the water tank and outside the tank.
   - Compressor to circulate the gas.
   - PLC to control the compressor pressure.
2. **Working:**
   - The heat exchangers are connected with gas pipes, creating a closed-loop system.
   - The compressor circulates the gas, which absorbs heat from the water tank and dissipates it externally.

- The PLC controls the compressor to maintain the desired temperature.

Solution 3: Using a Thermocouple

1. **Components:**
   - Insulation for the tank.
   - Bimetallic strip installed in the water tank, set to the desired temperature range.
   - Solenoid valve in the gas supply line, connected to the thermostat.
   - Nitrogen gas supply connected to the solenoid valve.
2. **Working:**
   - When the temperature exceeds a certain limit, the thermostat coils up and energizes the solenoid valve.
   - The solenoid valve releases nitrogen gas to cool the tank until the temperature drops to the desired limit.
   - A low temperature limit range (2-5 degrees Celsius) is set to minimize nitrogen gas loss.

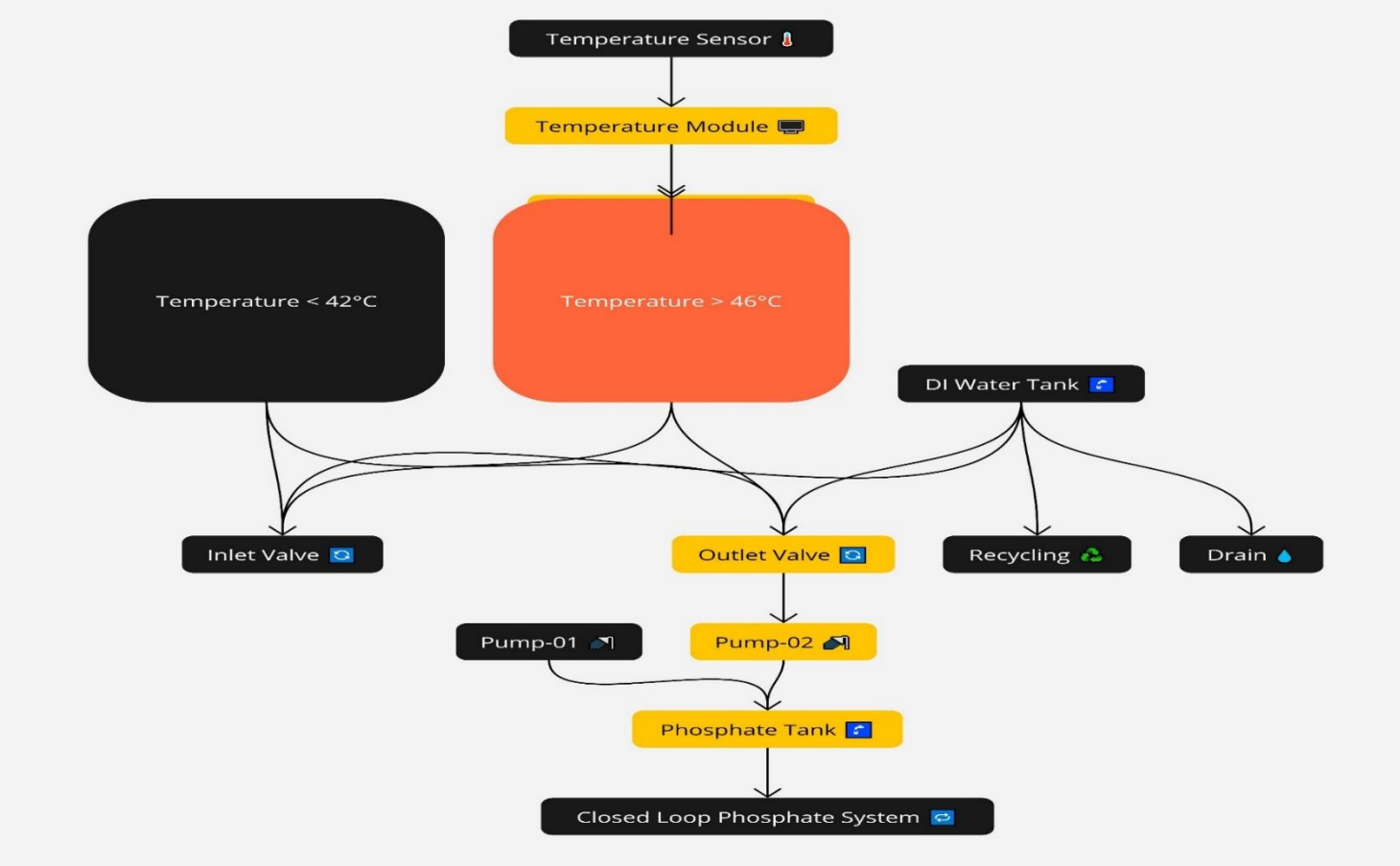
Comparison of Solutions

Feature	Solution 1: PLC based temperature control	Solution 2: Heat Exchanger Loop	Solution 3: Bimetallic Thermostat & Nitrogen Purge
Cost	Low (uses standard components and plc is already available)	Moderate (requires heat exchangers, compressor, piping)	Low-Medium (uses bimetallic strip, solenoid valve, nitrogen)
Efficiency	Low (wastes water, energy to heat new water)	High (closed loop, precise control)	Moderate (controls temperature but loses some heat)
Maintenance	Moderate (requires cleaning sensors, valves)	High (requires maintaining heat exchangers, compressor)	Low (relatively simple system)
Complexity	Low (uses basic control logic)	High (requires complex control of compressor pressure)	Moderate (needs thermostat calibration)
Suitability for Large Tanks	Not recommended (wastes too much water)	Best option (efficient, scalable)	May not be powerful enough for very large tank

Suitable Solution

Based on the criteria of cost, efficiency, maintenance, and complexity, **Solution 2: Gas Circulation System** is the best option for maintaining precise temperature control with minimal water waste and energy consumption. For smaller tanks, **Solution 1: PLC-Based Temperature Control** or **Solution 3: Thermocouple** could be suitable.

Flow Diagram for the proposed process:



Recommendations

1. Implement **Solution 2: Gas Circulation System** for large tanks, ensuring efficient and scalable temperature control.
2. For smaller tanks, consider **Solution 1: PLC-Based Temperature Control** or **Solution 3: Thermocouple** based on specific needs and resource availability.
3. Automate the monitoring and control processes to minimize manual intervention and reduce the risk of human error.

Conclusion

Effective temperature control of the phosphate pump's mechanical seal water tank is essential for the pump's performance and durability. After analyzing and comparing different solutions, the gas circulation system stands out as the most efficient and reliable method for large tanks. For smaller tanks, both PLC-based control and thermocouple solutions provide viable alternatives. Implementing these recommendations will enhance the operational efficiency and reliability of the phosphate pump system.

Internship Conclusion:

Throughout my internship, I gained valuable insights and hands-on experience in various aspects of manufacturing and quality control. By analyzing and implementing temperature control solutions for the phosphate pump's mechanical seal water tank, I learned the importance of selecting the right method for different tank sizes to enhance operational efficiency and reliability. The study of the Spot Welding Gun schematic provided me with a deeper understanding of the precision required in the welding process and its critical role in various industries. The lean manufacturing sessions emphasized the importance of streamlined processes for improved productivity. Additionally, my work in the Quality Control department highlighted the significance of rigorous maintenance protocols to ensure vehicle safety and performance. Finally, maintaining equipment in the TCF department underscored the need for regular inspections and updates to ensure the smooth operation of vehicle assembly systems. These experiences have equipped me with a comprehensive understanding of the key components and practices essential for maintaining high standards in manufacturing and quality control.