

**HONDA MOTORCYCLE AND**  
**SCOOTER INDIA**  
**PRIVATE LIMITED (HMSI)**



**INTERNSHIP REPORT**

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**MECHANICAL ENGINEERING**

**NIT KURUKSHETRA**

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**A PROJECT REPORT**

**Fuel Tank Scratch Defect Elimination**

*Submitted for partial fulfillment of award of the degree of*

**BACHELOR OF TECHNOLOGY**

In

**MECHANICAL ENGINEERING**

*By*

**RUPESH**

**NIT Kurukshetra**

**MECHANICAL DEPARTMENT**

## **CERTIFICATE**

This is to certify that the project report entitled “**Study for fuel tank scratch defect elimination**” **submitted** by Rupesh in partial fulfillment of the requirements of course at **Honda Motorcycle and Scooter India Private Limited (HMSI)**, as part of degree of Bachelor of technology in **Mechanical Engineering Department** of NIT Kurukshetra, is a record of confide work carried out under our supervision and has not been submitted anywhere else for any other purpose.

**Mr. Praveen**  
**(Executive, Paint Dept.)**

**Miss. Niyati Sinha**  
**(HR -Training &Communication)**

## **ACKNOWLEDGEMENT**

This report is based on the work led at **HONDA MOTORCYCLE AND SCOOTER INDIA PVT. LTD (HMSI) at Manesar, Gurgaon**, which is the most prestigious, and a leading group in manufacturing sectors, in India.

The contributions of those who ably helped me prepare background material for this report are hereby gratefully acknowledged.

I would like to express my deep gratitude to **Mr. Piyush Yadav, Production Manager**, who gave me opportunity to do training at Honda Motorcycle and Scooter India Pvt. Ltd. (HMSI).

I take this opportunity to express my gratitude and indebtedness to my mentor, **Mr. Praveen, Paint Dept.** for his perpetual inspiration, valuable suggestions and dynamic guidance during the course of this project semester.

In all my humbleness I place on record, in its first place, my sincere most thanks to **Mr. Harish Bhardwaj, Deputy Manager, Paint Dept. Mr. Davinder Deswal, Section head, Paint Dept.** who slated me for training on the project which I found to be interesting to study as an engineering student. . I also appreciate his great enthusiasm, capability to make people work as a team, leadership skills and an immense freedom; he has allowed me in my work, which indeed nurtured my self-confidence. His guidance encouraged me to complete the assigned projects.

The acknowledgement would be incomplete if contribution of whole manufacturing division is not applauded as a whole. I sincerely thank all of them for their cooperation and guidance during my tenure at **HMSI**.

## **EXECUTIVE SUMMARY**

Honda Motors And Scooters India Private Limited has a name in the field of motorcycles and motor scooters. After being established in 1999, in few years it has developed a reputation of providing world class products with a technology to suit Indian conditions. No doubt the policies and procedures followed by HMSI are of world standards but with growing competition and to cut cost in this price competitive market scope of improvement is always welcomed.

In this stint of 4 months I was deputed in PAINT SHOP department, the back bone of every organization. The things, which I had read only in the books, were practically seen and experienced in this memorable time span. I was assigned project, which is utmost importance to the PAINT SHOP department i.e. DPR.

I came to know the various processes involved in the manufacturing of the vehicles which in turn is very important in keeping the quality of the vehicle.

Through this project, I was assigned many problems of welding line. During this project I learned a lot of things about the 5-S rule, cause and effect analysis & counter measure, TQM (Total Quality Management) etc. which was very important from the industrial point of view. Apart from this I got the chance to take part in extra activities, which goes side by side with the regular work. I also got the opportunity to visit various other departments of motorcycle and scooter plant of the company to know & understand how the final vehicle was taking shape. I visited engine and frame assembly, vehicle quality area.

# **INDEX**

## **CHAPTER-1 INTRODUCTION**

- 1.1 Honda Corporate Profile
- 1.2 History of the Organization
- 1.3 Six Regional Headquarters
- 1.4 Honda's Products around the World
- 1.5 Introduction to HMSI
- 1.6 Management Board of HMSI
- 1.7 Few Key details about HMSI

## **CHAPTER-2 PLANT LAYOUT AND WORKING STRUCTURE**

- 2.1 Overview of HMSI
- 2.2 Plant Layout of HMSI
- 2.3 Flow Chart
- 2.4 Various Model names
- 2.5 HMSI Products
- 2.6 Honda's Philosophy
- 2.7 Company Vision
- 2.8 Two Fundamental Beliefs
  - 2.8.1 Respect for the Individuals
  - 2.8.2 The Three Joys

## **CHAPTER-3 HMSI PLANT**

- 3.1 Few of the in House Facilities
- 3.2 Welding Robots
- 3.2 Paint Shop Robots
- 3.3 Engine Assembly
- 3.4 Frame Assembly
- 3.5 Safety Used While Working in HMSI
- 3.6 HMSI Environment Policy

## **CHAPTER-4 INTRODUCTION TO PAINT DEPARTMENT**

4.1 Organization Structure

4.2 Paint Organization Structure

## **CHAPTER-5 PROJECT WORK**

5.1 Study of Paint Department

5.1.1 Paint Process

5.1.2 Removal of top defects contributing

## **CHAPTER - 1**

# **INTRODUCTION**



### ***1.1 Honda Corporate Profile:***

HONDA, one of the biggest brand names in the automobile world today, was founded by Mr. Soichiro Honda at Hamamatsu, Japan in 1948, since then the company has been growing by leaps and bounds satisfying customers all over the world with its comfortable world class products having most advanced technology.

Honda Motorcycle & Scooter India Private Ltd. (HMSI), a wholly owned subsidiary of Honda Motor Company Ltd., was incorporated in 20<sup>th</sup> August 1999.

### ***1.2 History of the Organization:***

Mr. Soichiro Honda was the founder of the organization, and the first plant of the organization was established at Hamamatsu (Japan) on 24<sup>th</sup> September, 1948.

He dreamed of providing people, everywhere in the world an economical means of transportation. He thought of better ways of making piston rings and found a company & began production. Then his company started producing small motorcycles, including one built in 1949 called D-type dream.

Then he thought of making high capacity motorcycles and taking them to racing. So his company made bigger and faster machines, two-, four-, five-, and six-cylinder race bikes and participated in the Isle of Man TT race (125 cc motorcycle class).



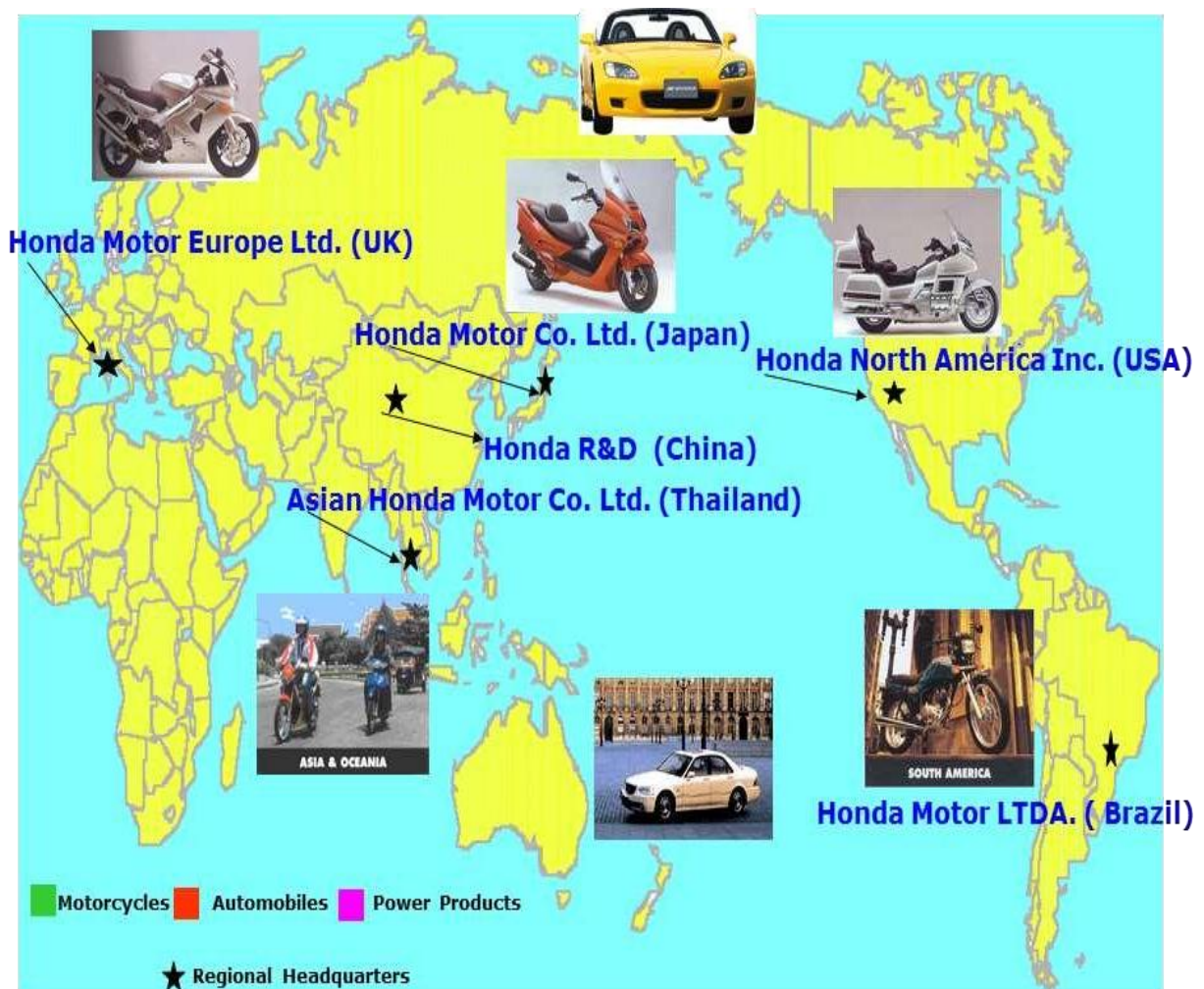
He wanted to share his new motorcycles with the world and therefore he opened American Honda Motor Co. in Los Angeles. Also Honda began manufacturing motorcycles at its Suzuka factory in 1960. Honda launched its first sports car, the S500 in Japan and entered Formula-1 in 1964.

In 1989, Soichiro Honda became the first Asian to be inducted into U.S. Automotive Hall of Fame. In 1990, Honda wins its fifth consecutive 1st ranking in the J.D. Power Consumer Satisfaction Index. In 1993, founder Soichiro Honda passed away. He dreamed of changing the way people looked at motorcycles and gave us machines that were powerful & fun to ride.

### 1.3 Six Regional Headquarters:

Six regional headquarters of the Honda throughout the world are written below:

- North/ Central America
- South America
- Afro-Europe
- Asia & Oceania
- Japan
- China



## ***1.4 Honda's Products around the World:***

Various Honda's products around the world are as follows:

- |                                |                       |
|--------------------------------|-----------------------|
| a) Scooters & Motorcycles      | b) Automobiles (Cars) |
| c) Power Products (Generators) | d) Robots (ASIMO)     |
| e) Trimmers                    | f) Lawn Movers        |
| g) Jet Engines                 | h) Honda Engine       |



Generators



Scooters



Honda Engines



Cars



ASIMO



MUV



Lawn Movers



Motorcycles



Trimmer



**Jet Engine** Fig: 1.1, Various Products of HONDA around the world

## ***1.5 Introduction to HMSI:***

Honda Motorcycle & Scooter India Pvt. Ltd. (**HMSI**), a wholly owned subsidiary of Honda Motor Company Ltd. was incorporated on 20th August 1999 to manufacture two wheelers in India. Its Symbol “Wings” is recognized all over the world as the symbol of Honda two wheelers with which they promise to initiate changes and make a difference in the lifestyle of the people of India. It represents the flight that **HMSI** has taken to achieve the goals and targets which conform to the international standards. Honda’s commitment to India is to manufacture world class two wheelers that are designed and best suited for local conditions. Ever since its establishment in 1999,



Fig: 1.2, Honda Motorcycle & Scooter India Private Ltd. IMT Manesar

HMSI has striven to offer products of the highest quality at reasonable price by following its fundamental belief of bringing joy to people. In a short span of Eight years, **HMSI** has emerged as the largest scooter manufacturer and the fourth largest two wheeler company in India. While endeavoring to meet and exceed the expectations of the customers, the critical importance of providing the product, technology and service that benefits the existing employees but also beneficial for the newly entered employees to understand the manufacturing flow process in plant. It is believed at **HMSI** that by meeting these expectations, **HMSI** will enhance the quality of life through products and services that reflect



the spirit of today. Bringing joy to people and contributing to social development will continue to be the principles that will guide **HMSI** in future. It came into mass production with Honda Activa in 2001. Since then, the company has continued to grow in the Indian market along with regularly providing world class, advanced and technically sound products. Living up to its illustrious lineage of excelling in the manufacture of two wheelers of global quality, HMSI has revolutionized the multi-dimensional Indian two-wheeler market with products like *Twister, Dio, Aviator, Unicorn, Shine, Dazzle, Stunner and Dream yuga* Apart from outstanding sales, Honda also caters its customers with excellent service and spare parts support. The **HMSI** factory is spread over 52 acres, with a covered area of about **85,815 square meters at Manesar, Gurgaon** district of Haryana. The foundation stone for the factory was laid on 14<sup>th</sup> December 1999 and the factory was completed in January 2001. The initial installed capacity was 100,000 scooters per year, which has reached 6, 00,000 scooters by the year by 2007 and motorcycle capacity shall be 4,00,000 per annum. The total investment outlay for the initial capacity was Rs.215crores and now the accumulated investment is 800crores.

### **HMSI mainly deals with**

- Manufacturing and sales of two wheeler.
- Manufacturing and sales of two wheeler engines.
- Service and sales of spare parts and accessories.
- Export of Honda products (CBU, Engine & Parts).

### ***1.6 Few Key details about HMSI:***

<b>1. Registered office</b>	Plot No. 1&2, Sector 3, IMT Manesar, Distt – Gurgaon
<b>2. Incorporation</b>	August 20th 1999
<b>3. Equity capital</b>	Rs. 300crores (Approx.7500 million yen)
<b>4. Area</b>	Covered area 85,815 sq. m (41 %)
<b>5. Product</b>	Motorcycle- Unicorn / Shine / Stunner / Twister / CBR/Dazzler/Dream yuga.  Scooters – Aactiva / Dio / Aviator
<b>6. Plant capacity</b>	1,000,000 per annum, SC – 600,000, MC –400,000
<b>7. Logo</b>	Wings
<b>8. President &amp; CEO</b>	Mr. Keita Muramatsu

***Table: 1.1, Few Key details about HMSI***

**CHAPTER – 2**

**PLANT LAYOUT AND**  
**WORKING STRUCTURE**



## ***1.1 Overview of the HMSI***

Area: 210,000 sq. m.

Production: 1.55million units/year

Location: IMT Manesar, Haryana

Incorporation: August 20<sup>th</sup>, 1999



Fig: 2.1: Overview of the HMSI Plant

## 2.2 Plant Layout of the HMSI

HMSI deals with the both the products in the two-wheeler segment. In this plant there are two sections one is scooter plant and other is motorcycle plant. In scooter plant all the models *Activa*, *Dio*, *Aviator*, *Lead* and *Beat* are being made. In Motorcycle plant *Unicorn*, *Shine* and *Stunner*, *Aviator* is being made.

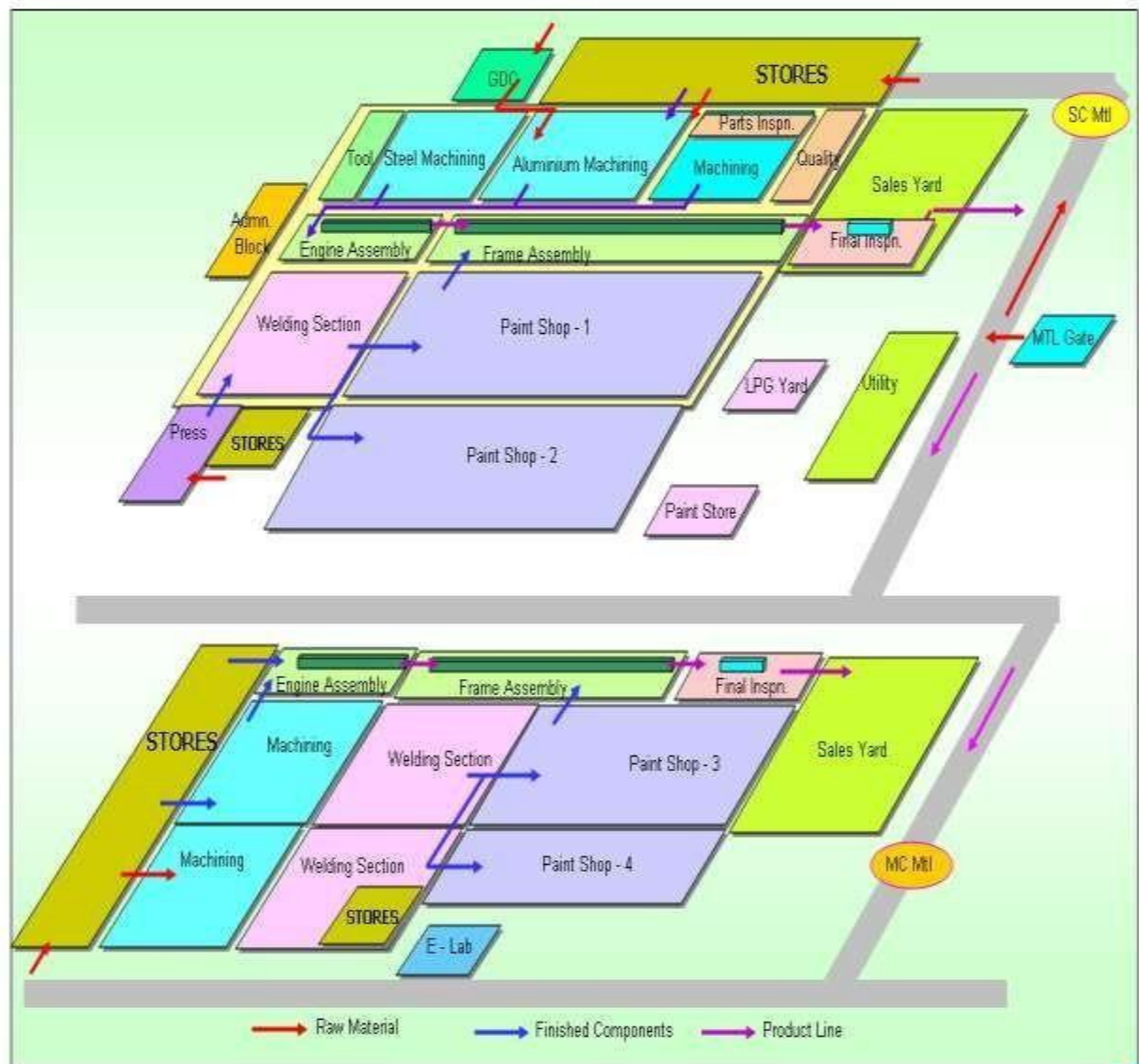


Fig: 2.2: Plant Layout of the HMSI

## 2.3 Flow Chart:

Various departments or sections within the HMSI are given below:

- Raw Material Storage
- Brought Out Parts (BOP)
- Press and Weld
- Paint Shop
- Machining Section
- Engine Assembly
- Frame Assembly
- Vehicle Quality
- Logistics

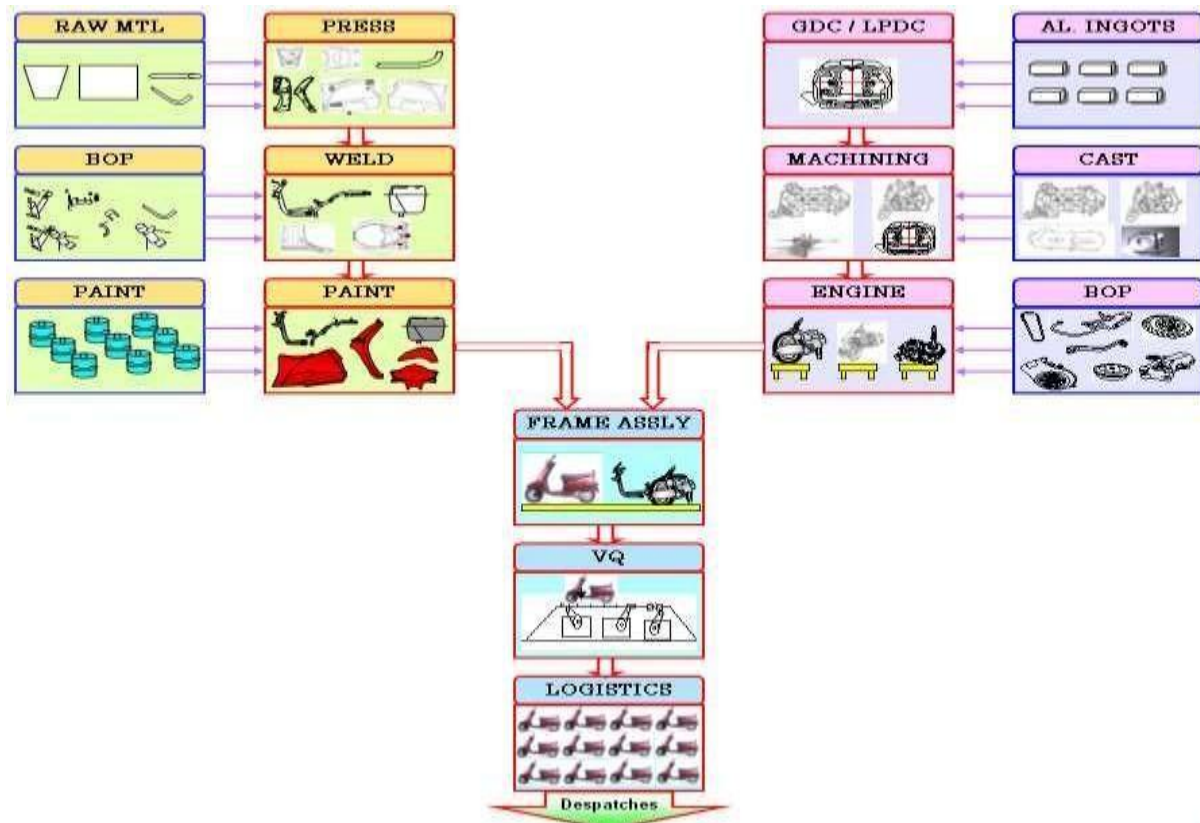


Fig: 2.3, Flow Chart for the production in HMSI

## 2.4 Various Models

HMSI has a number of models of scooters & motorcycles; they differentiate according to their model names & power. These are listed below:

Scooter & Motorcycle Name	Model Name	Power
Activa	6G	109cc
Dio	DLX,SMART	102cc
Aviator	KVT	109cc
Shine	Drum,Disc	125cc
Twister	CB	110cc
Stunner	CBF	125cc
Unicorn	CBF150M	150cc
Dazzler	CB	150cc
Honda CBR	650R	650cc
Dream yuga	CBS	110cc

Table: 2.1, Various Model names & their Power

## 2.5 HMSL Products:



**Active**  
Joy ON&ON



**Adventurer**  
Live your style



**Dio**  
GET NOTICED



**DASHER**  
ALWAYS BE THERE FOR YOU



**Twister**  
WAKE UP TO A DREAM



**UNICORN**  
BE A WING RIDER



**Spirit**  
POWER



**Shine**  
Woman's choice



**HORNET**  
WARRIOR



**CBR**  
150R



CBR 250

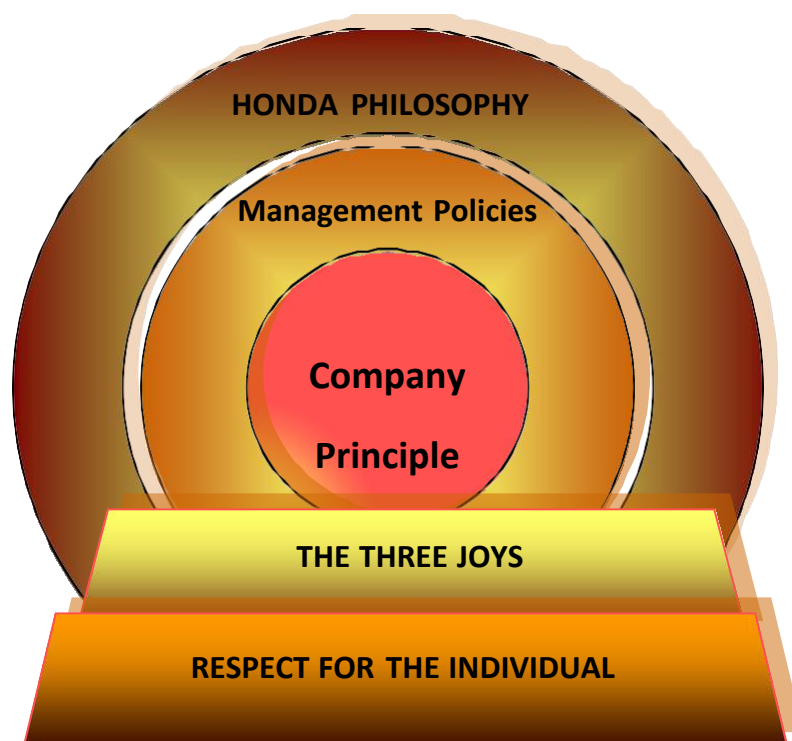


## ***2.6 Honda's Philosophy:***

Honda's philosophy has the various characteristics that are listed below:

- It provides every Honda associate around the world with a vision.
- It tells us the values of our business.
- It bonds everyone together towards a common mission.
- It provides a constant standard for correct action and ethical behaviour.
- It shows the link between the company's past, present and future.
- It challenges the organization to strive for the realization of its vision
- It helps our organization to maintain its sense of uniqueness.

Fig: 2.10, Shows the Honda's Philosophy



## 2.7 Company Vision:

Maintaining a global viewpoint, they are dedicated to supplying products of the highest quality yet at a reasonable price for worldwide customer satisfaction. HMSI has a basic policy that is MSQCD. This basic policy has the following description:

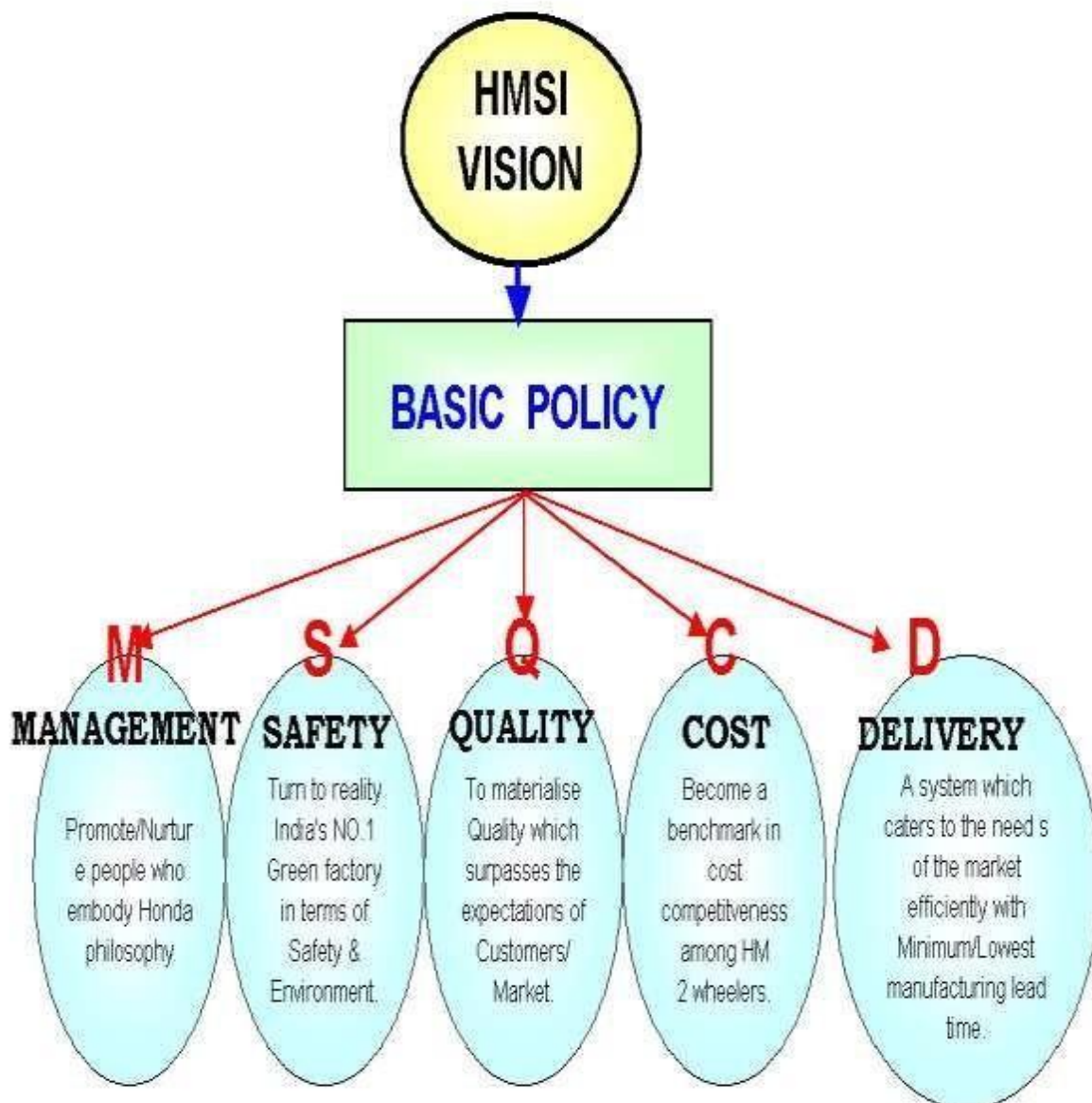


Fig: 2.11, Shows the Company vision

## 2.8 **Two Fundamental Beliefs:**

- Respect for the Individuals
- The Three Joys

### 2.8.1 **Respect for the Individuals**

Respect for the individuals recognizes the following core concepts:

- **Initiative:** Initiative means not to be bound by preconceived ideas, but think creatively and act on your own initiative and judgment, while understanding that you must take responsibility for the results of those actions.
- **Equality:** Equality means to recognize and respect individual differences in one another and treat each other fairly. Our company is committed to this principle and creating equal opportunities for each individual.
- **Trust:** The relationship among associates at Honda should be based on mutual trust. Trust is created by recognizing each other as individuals, helping out where others are deficient, accepting help where we are deficient, sharing our knowledge, and making a sincere effort to fulfill our responsibilities.

### 2.8.2 **The Three Joys**

Our goal is to provide Joy through our business: for those who buy our products ("The Joy of Buying"), engage in selling our products and services ("The Joy of Selling"), and are involved in business of creating our products ("The Joy of Creating").

▶ **The Joy of Buying** is achieved through providing products and services that exceed the needs and expectations of each customer. Importantly, the Joy of Selling and the Joy of Creating cannot be achieved without first bringing joy to the customer.





► The **Joy of Selling** occurs when those who are engaged in selling and servicing Honda products develop relationships with a customer based on mutual trust. Through this relationship, Honda associates, dealers and distributors experience pride and joy in satisfying the customer and in representing Honda to the customer.



► The **Joy of Creating** occurs when Honda associates and suppliers involved in the design, development, engineering and manufacturing of Honda products recognize a sense of joy in our customers and dealers. Formerly known as the "Joy of Producing," the Joy of Creating occurs when quality products exceed expectations and we experience pride in a job well done.



## **CHAPTER – 3**

# **HMSI PLANT**

### **3.1 Few of the In-House Facilities**

High Pressure Die Casting, Gravity Die Casting & Low Pressure Die Casting  
Gravity Die-Casting & Low pressure Die Casting Sections are for manufacturing critical engine parts.



### **3.2 Welding Robots**

Weld Shop has spotwelding, seam welding and MIG welding machines to weld various sheet metal parts to form the basic frame and other scooter panels.



### **3.3 Paint Shop Robots**

Paint Shop has a conveyor system, which is unique amongst all Honda Factories in the world. The conveyor car carrying the parts is rotated and dipped so as to enable good paint adhesion, high gloss and superior paint finish. Robots are used in painting for improved paint finish.



### **3.4 Engine Assembly**

Engine Assembly is done in an enclosed air pressurized area to protect the engine from dirt and dust. Each of the engines is then inspected for various parameters.



### **3.5 Frame Assembly**

Frame Assembly is done at the slat conveyor. After the Frame Assembly line is the roller tester to check the final scooter quality before handing over to dispatch.

### **3.6 Safety Used While Working in HMSI**

Various safety precautions used inside the plant are given below:

- |                       |                 |
|-----------------------|-----------------|
| a) Cotton Hand Gloves | b) Arm Guard    |
| c) Arm Sleeve         | d) Face Mask    |
| e) Helmet             | f) Safety Shoes |
| g) Goggles            | h) Apron        |
| i) Ear Plug           |                 |



### **3.7 HMSI Environment Policy**

As responsible members of society and industry, we Honda Motorcycle & Scooter India Pvt. Ltd (HMSI), Manesar manufacturer of two wheelers, recognize that wellbeing of humans and conservation of earth's environment is important. By adopting Environment management system, HMSI is fast moving towards realization of Honda's Green Factory Concept.

We shall endeavor to continually monitor, improve and conserve the environment in which we operate. HMSI is committed to achieve, environmental excellence in all its Industrial activities, in the following ways:

- Conserving environment through preventing pollution at its source of generation and strengthening our existing pollution control system.
- Promoting Conservation of resources such as energy, water, oil and grease and other Raw materials, by reusing, recycling and minimizing the waste generation.
- Complying with all applicable legal/ regulatory requirements and strive to go beyond wherever possible.
- Regular monitoring and reviewing of environmental objectives and targets. Increasing environment awareness and competence amongst our employees and encourage Vendors and dealers to adopt EMS.

HMSI will continually improve its environmental management system following PDCA Cycle to make it more effective. The Policy will be well disseminated to our employees as Well as persons working on our behalf and to public at large.

## **CHAPTER – 4**

# **INTRODUCTION TO** **PAINT DEPARTMENT**

## **PAINT SHOP**

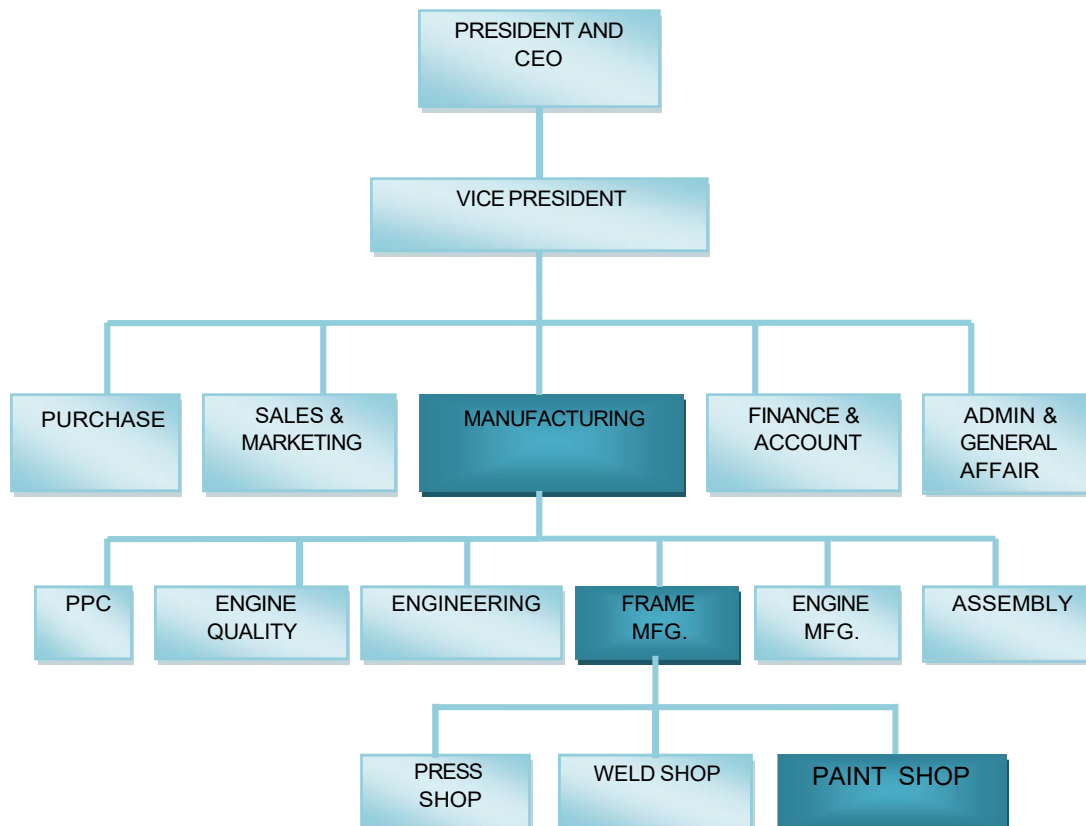
The paint department is one of the most important departments of the organization where the organization has its own production. The paints are the most important and critical area of any automobile industry. Paint department of Honda Motorcycle and Scooter India Private Limited (HMSI) is responsible for all the colors which occur in the market. Paint department is the only department which covers the fifty percent area of the plant. Industry is incomplete without Paint Shop. And Paint Shop is only responsible for appearance of the vehicles. It gives colors to the vehicles.

### **Necessity of Painting**

1. Colour and appearance.
2. Covering the gaps between the weld joints.
3. Corrosion resistance
4. Makes Components Rust free.
5. Makes surface appearance shiny and good.

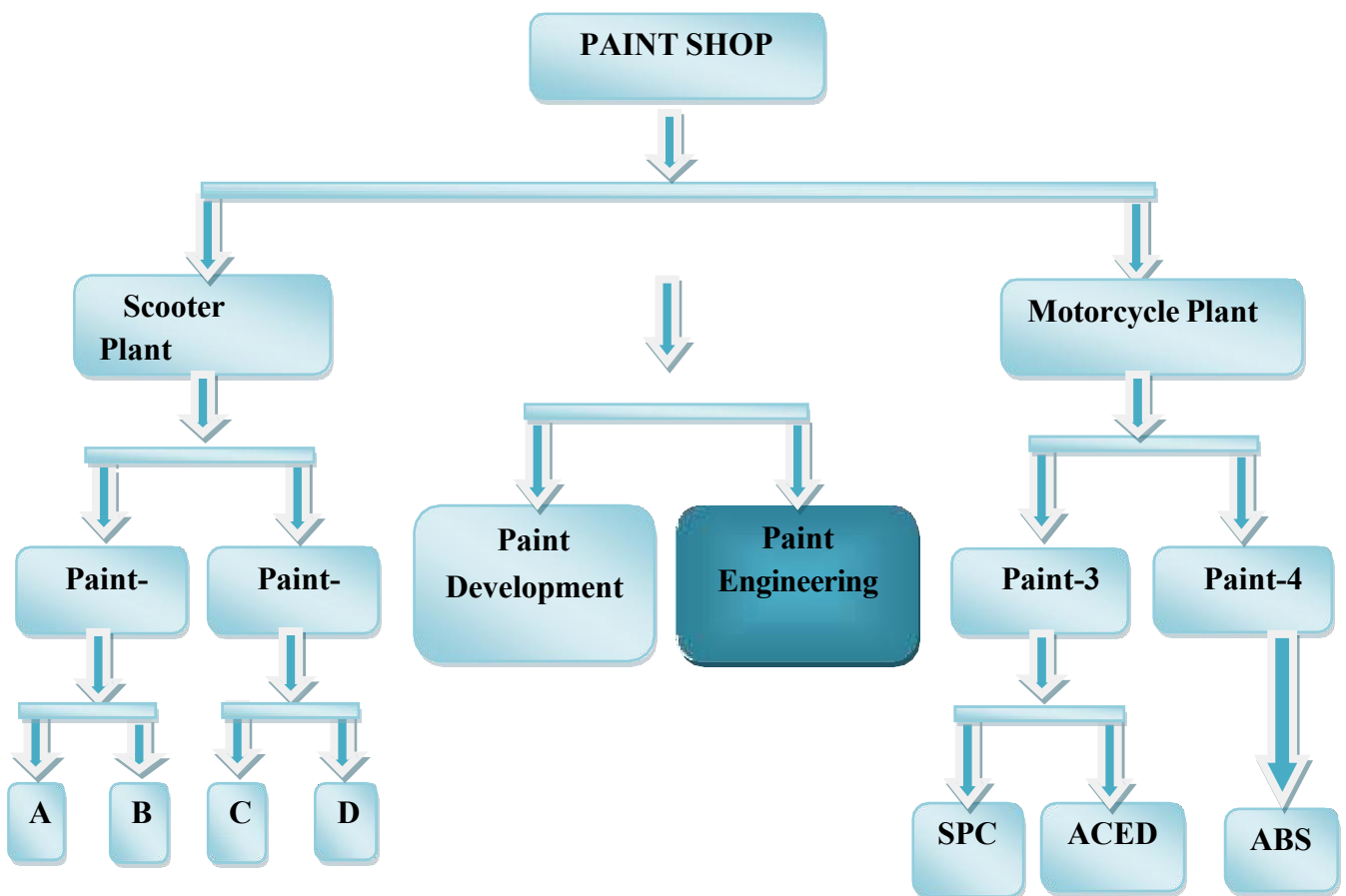


## 4.1 Organization Structure



## 4.2 Paint Organization Structure

Paint Shop Organization Structure and There Different Departments are shown below in the figure.



**CHAPTER – 5**

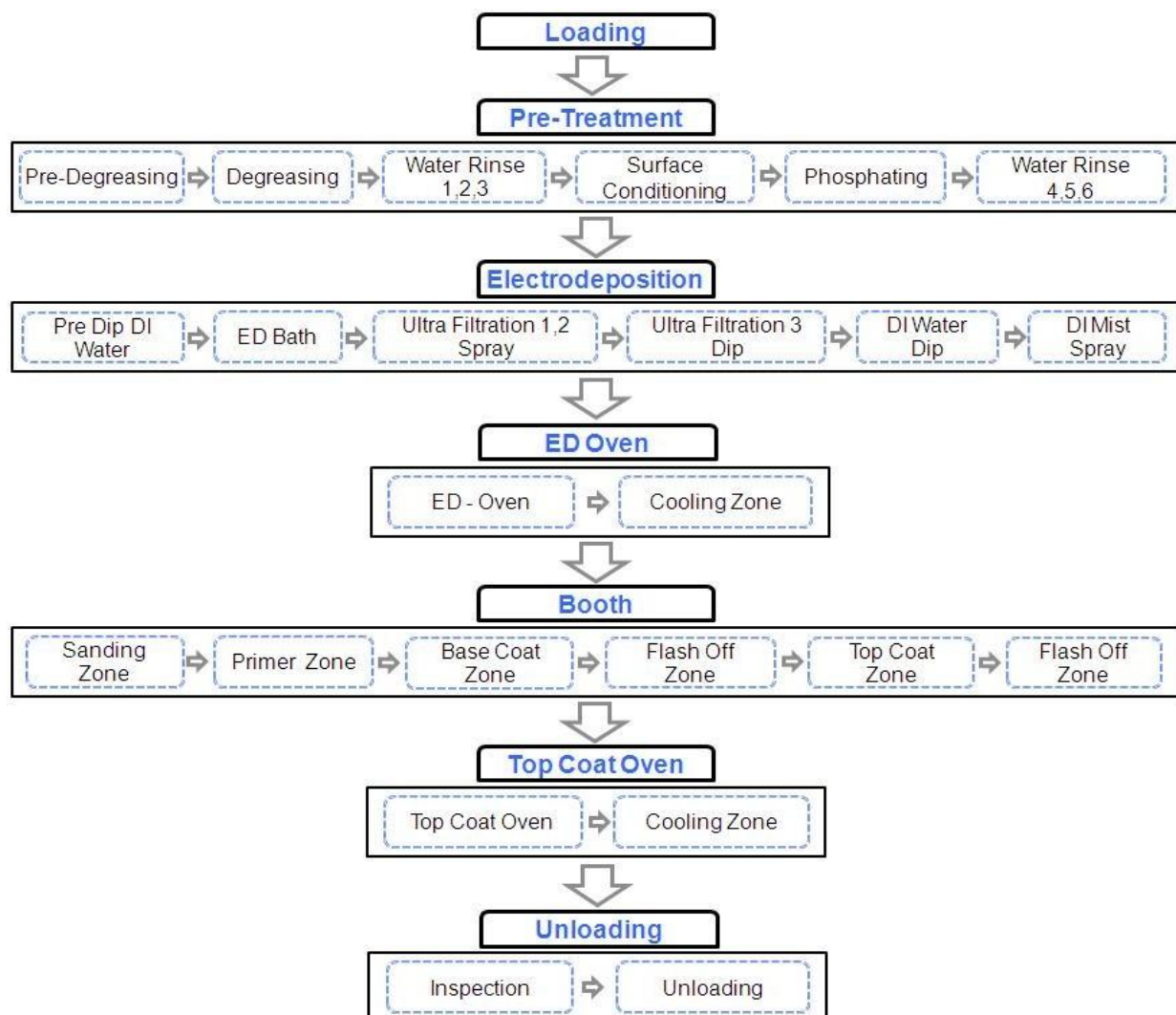
**PROJECT WORK**

## 5.1 **STUDY OF PAINT DEPARTMENT**

### 5.1.1 **Paint Process**

Paint section is very important section. In this section, different treatments are done on the body covers, frame body and fuel tank and it is a step by step process done as follows. Here shows the process layout of the paint department.

#### **Process Flow Chart**



## **Process Full Description**

**Loading** - Material come to press shop in form of metal sheet, in press shop it is pressed in desired shape while pressing they use some lubricants, oil, grease in order to make pressing operation smooth. After that the material transfer to weld shop for welding then sends towards loading station where it loaded for PT. The components come from weld shop through trolleys& conveyors. Here the components to be painted are loaded on the jigs for further treatment of the components. These Jigs are attached with carrier & carriers are attached with conveyors. The conveyor is responsible for movement of components & carrier for movement of the jigs. Different types of jigs are used for different types of vehicle parts.



**Pretreatment**- Pre-treatment means the process by which the object surface is cleaned & prepared for painting or coating which is applied subsequently. Pre-treatment plays very important role in the future of object. One can say that “Paint decides life of object & pre-treatment decides life of paint”. Pre-treatment improves quality of painting. It gives very good adhesion of primer, electro coat and paints to the metal substrate and hence increases the life of painted component.

Purpose of pre-treatment is to clean the surface by removing the occulted oils, grease, lubricants, dust, and dirt which comes the surface of body in pressing, welding and loading of the components.

Pretreatment is done to make the surface of the component viable for electro-deposition & make the surface clean from greases, oil, dust & make it anti corrosive and rust free. The pre-treatment process involves following stages:

- 1. Pre-Degreasing:-** To remove oil, grease and dust from the component by Saponification & Emulsification reactions and make the surface clean. In this process, Nipaklin 364S chemical is used.
- 2. Degreasing:-** The 80 to 90% of the oil and grease is removed by the pre degreasing process. To remove all the oil and grease from the part it is again reacted by the degreasing chemical. The process is same for pre degreasing and degreasing. In this process, Nipaklin 364S chemical is used.
- 3. Process Water Rinse 1, 2, 3:-** Water rinsing is helpful to remove degreasing chemical solution carried by the surface. In this process, the Process water is sprayed by nozzles and the part is cleaned reducing the effect of degreasing chemical from the components. The part becomes ready for the next process.
- 4. Surface Conditioning:-** To prepare the surface for uniform coating of phosphorus. Part roughness also increases in this process to activate the body for phosphating. In this process, Titanium Oxide is used for etching. Titanium salts form fine colloids which get adsorbed on the metal sprayed in surface conditioning bath.

**Function:** Adsorbed titanium colloids provide fine active nuclei for phosphating reaction.

**5. Phosphating:-** Phosphating is a process in which metal Surface is brought in contact with the solution containing zinc, nickel or manganese, phosphoric acid, accelerator & other additives. It is also a spraying process using heated zinc phosphate solution.

The treatment produces a reasonably hard, Electrically non conducting surface coating which is highly adherent to the metal surface. Phosphating acts as a base for ED. It prevents the part from rust and corrosion. It provides finely crystalline non metallic phosphate coating which inhibits corrosion resistance & improves adhesion & durability of the paint finish.

**6. DI Water Rinse 4, 5, 6:-** In this process De-Ionized Water is used as spray treatment. It is used to remove the excess phosphorus deposited on the surface. It provides contamination free phosphate surface prior to painting.

**Electron-Deposition Process-** This process is carried out mainly to apply coating on a component in order to prevent it from corrosion and other environmental attack. It also provides adhesion for further coating of paint. It makes the surface better corrosionresistant and more durable after the paint process is complete.

1. **DI Water Dip:** In pre-treatment process, cleaning is done by spray process so some area remains without pre-treatment in which cleaning is not possible. So in this process the body is dipped in the DI Water tank to make the surface clean for ED and remove excess of PT chemicals.



2. **ED Process :** In this process, body is coated with paint with the help of current or charge. Simply, in this process the body gets the negative charge(cathode) and paint as positive charge(anode) through anode cell dipped in the ED bath carrying positive current. When both paint and body comes in contact with each other electrons get transfer from one place to other forming a uniform layer of paint coating on the surface of body.



## **What is Electro Deposition ?**

*“It is dipping process in which electrically conductive substrate immeresed in a waterborne paint. The paint dispersed in water is electrically deposited on the substrate to form a uniform & water insoluble film.”*

- Deposition of film takes place by increase in pH.
- Paint gets deposited continuously through concurrence of four different phenomenon:
  - i. ELECTROPHORESIS
  - ii. ELECTRODEPOSITION
  - ii. ELECTROLYSIS
  - iv. ELECTROSMOSIS

### **ELECTROPHORESIS:**

Electrically charged substances (dispersed particles, soluble resins) move to the electrodes.

- Positively charged paint moves to the substrate.

### **ELECTRODEPOSITION:**

- In solubilisation of resin takes place.
- Positively charged resin gets deposited on the substrate after electrical discharging.

### **ELECTROLYSIS:**

- Electrolysis of water takes place.
- Cathode generates  $H_2$ .

### **ELECTRO OSMOSIS:**

- Water contained in the film moves against the current of phoresis of resin due to electric potential difference.

### **Advantages of ED coating:**

1. Corrosion resistance of car body increases.
2. Paints are deposited even on surfaces inaccessible to conventional methods of painting.
3. Uniform film of desired thickness is obtained easily by adjusting voltage.
4. Quantity of drag-out solids is small since bath paint being diluted with water is low in solid content.
5. Automation & faster production rate.
6. Higher degree of paint utilisation up to 95% or more..
7. No chance of sagging, solvent popping etc & hence better finish & appearance.
8. Less labour intensive.
9. Free from fire hazards & Environment friendly.

### **Standard Specifications**

- ED MAIN TANK :
  - Solid content is  $11 \pm 1$  % (NV)
  - Specific conductivity is 600-1200  $\mu\text{S/cm}$
  - pH is  $6.1 \pm 0.3$
  - Paint temperature is  $28 \pm 2^\circ\text{C}$
- ED application voltage is 140-180 V
- ED oven temperature is  $170 \pm 5^\circ\text{C}$

3. **Ultra Filtration:** To remove the extra ED from the part's surface. It also prevents wastage of extra ED paint. Ultra filtration means extremely fine filtration. It is used to recover the paint taken out from the bath, filter the paint under a pressurized condition, utilizing the filtrate as the rinsing water & extracted paint is again transfer to the ED bath for its proper utilisation. UF 1&2 is done by spraying process & UF 3 is done by dipping process. It is done to remove excess paint deposited on a component.

#### **Advantages of UF**

1. Efficient separation without the aid of heat or any coagulating agent.
2. Properties does not get affected.

4. **DI water spray tank:** It is done to wash out any traces carried over from UF 3.

**Mist spray:** In this tank air with very less amount of water is blower over the component. It is done to remove any water marks present on a component.

**ED Oven:** It is used to bake ED Painted parts for proper application of paint. It removes moisture and bakes ED. Here the component is baked to 170 - 180°C in an oven. This causes the different polymer chains to crosslink (i.e. bind to each other in many places) forming a very strong, flexible, interconnected network of polymer over the whole surface of the component. In oven, Liquefied Natural Gas (LNG) is used for combustion.

**Cooling Zone:** Baked part is then cooled by air blow at room temp. Cooling is necessary in order to make up the component for further painting process.

**Paint Booth:** Paint booth is central core of any paint shop. The main painting process is carried out in paint booth. Here the components are painted for protection, providing luster and gloss to the component.

Paint booth consists of following different zones.

1. Sanding and cleaning zone.
2. Base coat application zone.
3. Flash off zone.
4. Top coat application zone.
5. Settling zone.

### **1. Sanding Zone:**

This zone helps to expose fault & remove minor problem & catches dust by sanding paper. In sanding zone SPC components are sanded with sanding paper of grid size 400(solid) & 600(metallic). Then cleaning is done by tag-rag application. But ABS parts are cleaned firstly by IPA (Iso Propyl Alcohol) application and then air is blown over it (Pr. is 4-6Kg/cm<sup>2</sup>).

### **2. Base coat zone :**

This zone provides desired color to the vehicle. In this zone paint is applied manually or by robotic application. It serves as a base for top coat. Electrostatic gun is used for painting purpose. Distance of gun from component is kept at 20-25 inches.

### **3. Flash off zone:**

This zone provides time for the component such that solvent present in paint should be evaporated from the component. Simply the Component is partially dried off in this zone. This zone is around of 7 minutes.

### **4. Top coat zone:**

It adds luster & hardness to the paint finish while protecting the base coat for UV radiation. In this zone paint is applied on the component for good shade & luster of the Component.

### **5. Settling zone:**

This zone provides time for the component such that solvent present in paint should be evaporated from the component. Simply the Component is partially dried off in this zone. This zone is around of 7 minutes. This zone is provided for setting of paint before entering in oven. It is necessary in order to avoid popping defect, pin hole defect.

**Top Coat Oven:** It is used to bake the painted parts for proper application of paint. It removes moisture and dry the paint. Here the component is baked to 150 - 160°C for SPC parts & 60-70°C for ABS parts. This causes the different polymer chains to crosslink forming a very strong, flexible, interconnected network of polymer over the whole surface of the component. In oven, Liquefied Natural Gas (LNG) is used for combustion.

**Cooling Zone:** Baked part is then cooled by air blow at room temp. Cooling is necessary in order to make up the component for further painting process.

**Inspection:** This is the final station of the paint shop & is of the most importance, as defects are bound to occur but a thorough inspection can spot the defects out & the parts can be corrected right there or can be sent to t/up area or rework area for further correction of the defected parts. These parts are marked so that their further inspection would be easier.

**Unloading:** In this area components are unloaded from the jig. Then they are separated as OK parts, NG parts. The NG parts are sent to rework area & touch up area. The OK parts are sent to frame assembly.

## **Paints Defect:-**

S No.	Defect	Causes	Appearance
1	Dust	Dust from environment, Paint, Oven	Irregular particle and pattern on areas.
2	Orange Peel	Excessive or Poor Painting	Uneven surface formation, texture like skin of an orange.
3	Mottling	Gun not reaching the area	<p>a) Spotty, non-uniform, blotchy appearance of metallic paint.</p> <p>b) Small, darker in color, irregular areas or spots in solid paint.</p>
4	Cissing	Due to oil marks	Appears as a small crater - like an opening in the finish after it has been applied.
5	Gun Spitting	Choking of gun	Tears or curtains of paint on vertical or inclined areas of unit.
6	E.D. Line	Extra Stoppage in P.T	Lines shown on the part
7	Popping	Excessive Base Coat/Improper thinner mixed	Small bumps in paint film which, under close examination, have small holes in the top.
8	Dent/Scratches	From Weld/Due to paint hangers	Mark on the body.

<b>9</b>	<b>Color Difference</b>	Paint Maker/Painter	Does not match color standard
<b>10</b>	<b>Overflow</b>	Exc. Painting/Humidity	Paint is excesses on the body
<b>11</b>	<b>Water Mark</b>	Improper treatment	Air Tiny holes in the finish, putty or body filler usually the result of trapped solvents, air or moisture.



## **Process of removal of scratches**

### **Light Surface Scratches:**

- 1) Use a fine polishing compound to gently buff out light scratches.
- 2) Apply a small amount of soft cloth and rub it onto the scratched area in a circular motion.
- 3) Wipe off excess compound with a clean cloth.

### **Deeper Scratches:**

- 1) For slightly deeper scratches, wet sanding can be effective.
- 2) Use very fine sand paper and sand the scratch area gently in a circular motion.
- 3) Keep the sand paper wet to avoid damaging the paint.
- 4) After sanding, apply polishing compound to restore shine.

### **Touch-up paint:**

- 1) We will use touch up paint that matches with bike paint.
- 2) Apply the paint carefully to the scratch and let it dry.
- 3) Now use polishing compound for shine.

### **Metal- Frame:**

- 1) On the metal frame use a metal polish to buff out minor scratches.
- 2) Apply the polish to a soft cloth and gently rub the scratch the rub area.
- 3) Wipe off excess polish with a clean cloth.



## Carbon Fiber Frame:

- 1) For carbon fiber frame use very fine sandpaper to sand the scratched area gently.
- 2) Be cautious not to sand too aggressively, as carbon fiber can be delicate.

## Plastic Parts:

- 1) For plastic part we will use a heat gun on a low setting.
- 2) Gently heat the scratched area.
- 3) Sometimes heat helps the plastic regain its original form, reducing the appearance of scratch.



### Top Defects contributing:

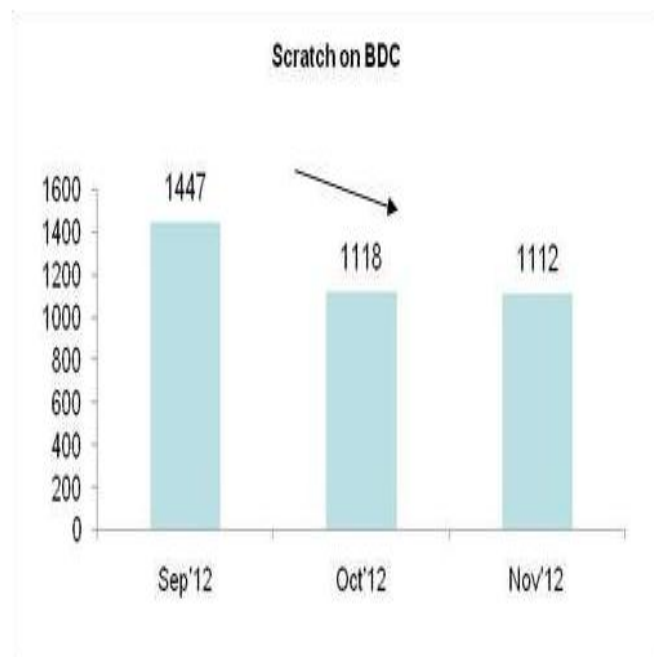
S.No.	Defect Phenomena	Contributing %
1.	Scratch on BDC	25 %
2.	Dust on BDC	15 %
3	Paint poor on BDC	10 %
4.	Paint poor on FC	09 %

## Scratch on BDC

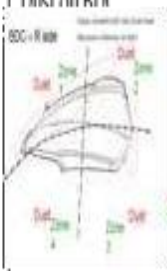
	Why1...?	Why2...?	Why3...?	Why4...?	Why5...?	Conclusion
Occurrence	Scratch on BDC	BDC hitting the pillar at A line unloading. (trolley fixed at production line).	Pillar in the way from A line to PBS loading point			Remove the pillars provide the adequate space for movement or do the masking
Outflow	Scratch are normally generated after paint Q gate					Q gate provided at AF off.

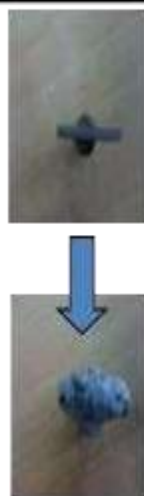


## Countermeasure Effectiveness

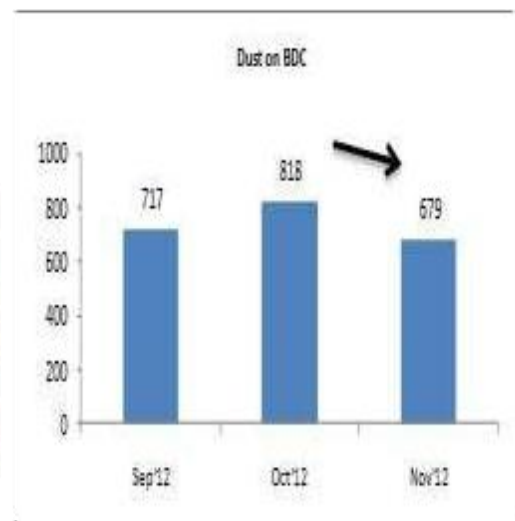


## Dust on BDC

	Why1...?	Why2...?	Why3...?	Why4...?	Why5...?	Conclusion
Occurrence	<p>Dust on RNY</p> 	Dust on BDC is found on the upper side (as shown in picture)	Dust generate due to loose bolting of parts.	Bolting is not done properly by loading person.	Paint accumulation on bolts due to delay in stripping	Bolts to be tighten properly & review of stripping schedule
	Dust on BDC	Dust visibility more on parts	DFT found less 9~10μ against 13~14μ.	Anode cells removed from ED	Due to life detritions of plates inside	Anode cell to be provided
Outflow	Only Q gate after baking of part. (Inspection area)	Negligence of inspector				Daily information via meeting & VQ reports displayed



## Countermeasure Effectiveness



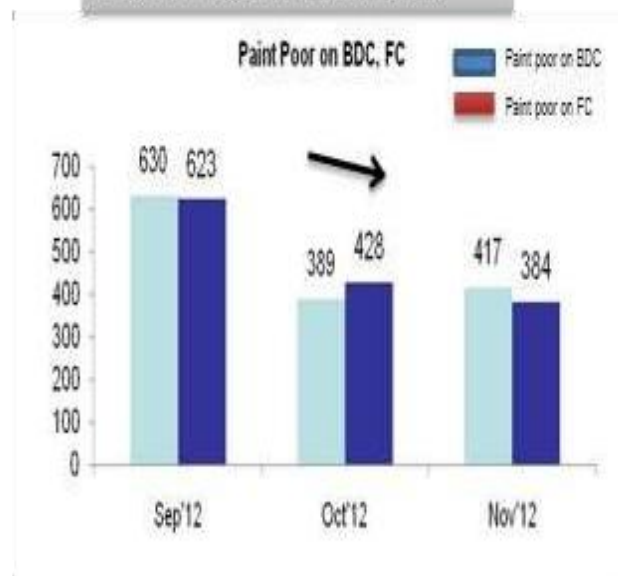
## Paint Poor on BDC & FC

	Why1...?	Why2...?	Why3...?	Why4...?	Why5...?	Conclusion
Occurrence	Paint poor/thin on BDC & FC	This is observed on the edges of the BDC & FC & upper area of BDC	Painting missed at the edges			Robot painting modified. Instruction to operator.
	Paint poor/thin on BDC & FC	R264 (Lucid red) touch up parts are counted in paint poor	Touch up of parts is difficult and leave patches in R264	Being a cocktail color its difficult to do touch-up as compared to metallic shades		Avoid touch-up of parts. Later shifting it to metallic shade
Outflow	Only Q gate after baking of part. (Inspection area)	Negligence of inspector				Daily information via meeting & VQ reports displayed






Properly paint on edges through manually inside booth.

## Countermeasure Effectiveness



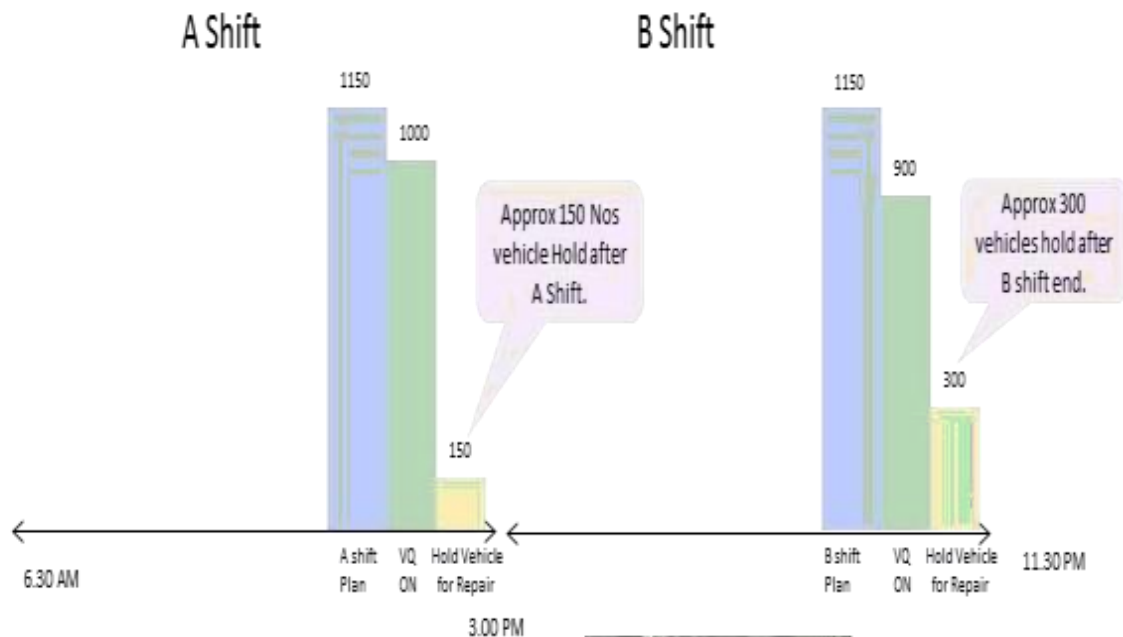


An outlay of the above theory:

S No.	Problem / Observation	Picture	Root Cause	Countermeasure
1	Scratch on BDC		<ul style="list-style-type: none"> <li>• Loading of BDC just prior to the frame. Thus frame hits the BDC &amp; scratch it.</li> <li>• Pillar in the way from A line to PBS loading point</li> </ul>	<ul style="list-style-type: none"> <li>• BDC to be loaded after the frame</li> <li>• Remove the pillars provide the adequate space for movement or do the masking</li> </ul>
2	Dust on BDC		<ul style="list-style-type: none"> <li>• Paint accumulation on bolts due to delay in stripping.</li> <li>• Due to life detritions of plates inside</li> </ul>	<ul style="list-style-type: none"> <li>• Bolts to be tighten properly &amp; review of stripping schedule.</li> <li>• Anode cell to be provided</li> </ul>
3	Paint poor on BDC		<ul style="list-style-type: none"> <li>• Painting missed at the edges.</li> </ul>	<ul style="list-style-type: none"> <li>• Robot painting modified. Instruction to operator.</li> </ul>
4	Paint poor on FC		<ul style="list-style-type: none"> <li>• Deep sending on cocktail shades, difficult to touch up.</li> </ul>	<ul style="list-style-type: none"> <li>• Avoid deep sending on cocktail shade.</li> </ul>
5	Dust on RCC, FHC, FC		<ul style="list-style-type: none"> <li>• Dust from oven.</li> <li>• Environmental dust</li> </ul>	<ul style="list-style-type: none"> <li>• PM schedule of booth &amp; oven to be strengthen.</li> <li>• Dummy body with tacky warnish to be passed through booth &amp; oven for dust reduction.</li> <li>• Outflow to be control</li> </ul>

## Further Activity Plan to Reduce Top Defect

### Top Defect : Scratch on BDC



- Scratch generates in vehicle accumulated after A Shift.
- Hold Vehicles repaired in Weld & AF repair areas and VQ on .  
[Many defects of BDC Scratch reported in these vehicles.]

**Countermeasure : Polisher to be deployed before VQ.**



### Defect trend : Daily

Shift A : 50 [approx]

Shift B : 80 [approx]

Shift C : 80 [approx]

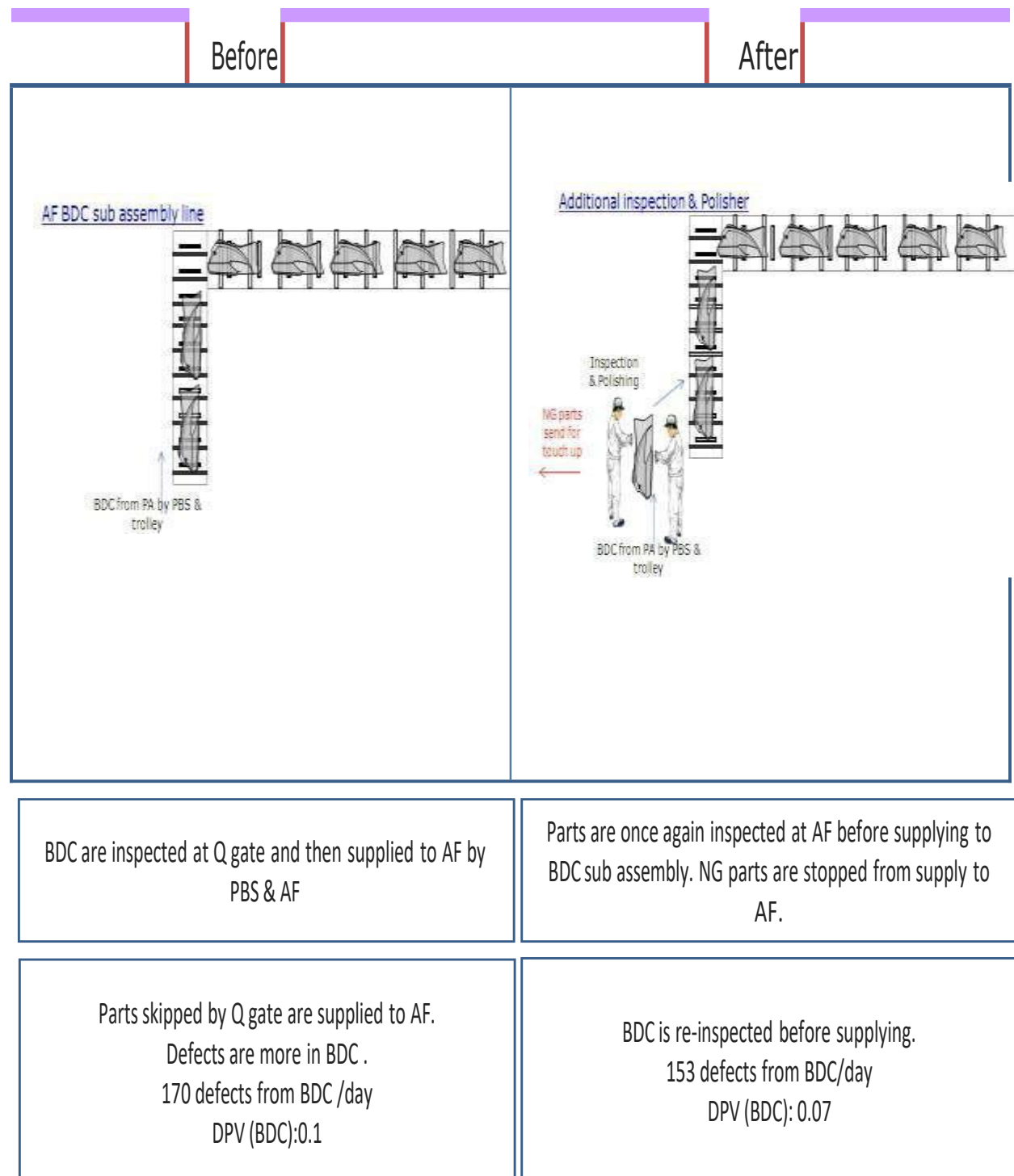


- >> No. of defect reported in C shift are more than A & B Shift
- >> BDC Scratch and Paint poor are TOP defects reported in C Shift  
Reason : Operator Negligence in C Shift [Polishing not done properly]

**Concept/Rule to be made : Hole vehicles not more than 30 Nos after shift End.**



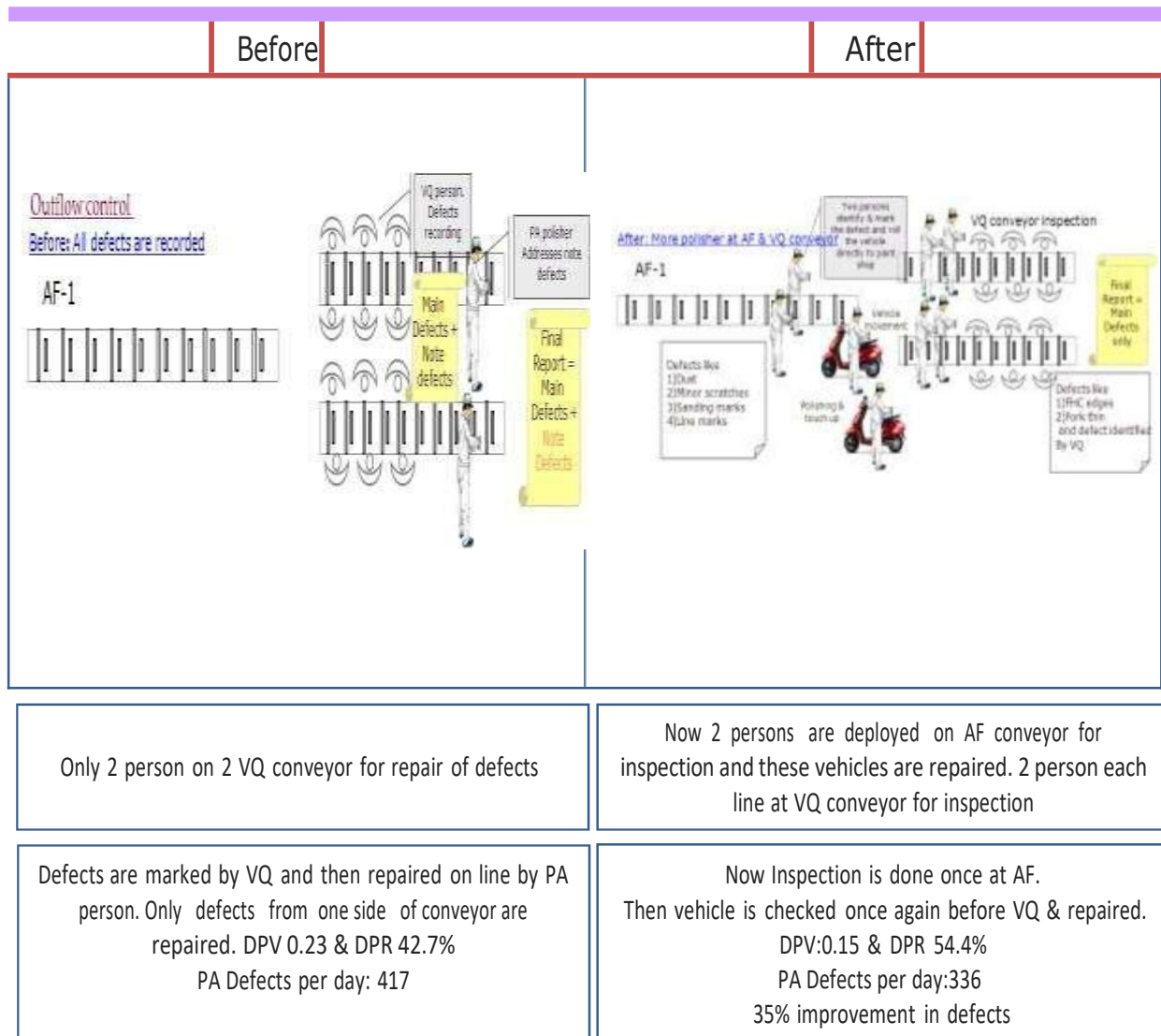
Below diagram shows what was happening on BDC line and what is now happening



**Below diagram shows what was happening on Assembly line and what is now happening**

KWPG

PA-SC



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