



**Skill India**  
कौशल भारत - कुशल भारत



सत्यमेव जयते  
GOVERNMENT OF INDIA  
MINISTRY OF SKILL DEVELOPMENT  
& ENTREPRENEURSHIP



N.S.D.C.  
National  
Skill Development  
Corporation

Transforming the skill landscape

**PAINTS AND  
COATINGS  
SKILL COUNCIL**



# Facilitator Guide

Sector  
Paints and Coatings

Sub-Sector  
Application

Occupation  
Powder Coater

Reference ID: PCS/Q5102, Version 1.0  
NSQF Level: 4

## Powder Coater

**Published by**

**All Rights Reserved**

**First Edition, October 2016**

**Copyright © 2016**

## Paints and Coating Skill Council

105, Kakad Chambers,

132, Dr. Annie Besant Road,

Worli,

Mumbai 400 018

Email: [info@pcsc.in](mailto:info@pcsc.in)

Phone: +91-22-24931790

## Disclaimer

The information contained herein has been obtained from sources reliable to Paints and Coating Skill Council. Paints and Coating Skill Council disclaims all warranties to the accuracy, completeness or adequacy of such information. Paints and Coating Skill Council shall have no liability for errors, omissions, or inadequacies, in the information contained herein, or for interpretations thereof. Every effort has been made to trace the owners of the copyright material included in the book. The publishers would be grateful for any omissions brought to their notice for acknowledgements in future editions of the book. No entity in Paints and Coating Skill Council shall be responsible for any loss whatsoever, sustained by any person who relies on this material. The material in this publication is copyrighted. No parts of this publication may be reproduced, stored or distributed in any form or by any means either on paper or electronic media, unless authorized by the Paints and Coating Skill Council.





**Shri Narendra Modi**  
Prime Minister of India

“ Skilling is building a better India.  
If we have to move India towards  
development then Skill Development  
should be our mission. ”



## Symbols Used



Steps



Time



Tips



Notes



Objectives



Do



Ask



Explain



Elaborate



Field Visit



Practical



Lab



Demonstrate



Exercise



Team Activity



Facilitation Notes



Learning Outcomes



Say



Resources



Activity



Summary



Role Play



Example



## Table of Contents

S. No	Modules and Units	Page No
1.	<b>Introduction</b>	<b>1</b>
	Unit 1.1– Icebreaker	3
	Unit 1.2– Objectives of the Course	5
	Unit 1.3– Paints and Coatings Sector in India	7
	Unit 1.4– Career Progression	9
2	<b>Prepare for Coating (PCS/N5105)</b>	<b>11</b>
	Unit 2.1– Basics of Powder Coating	13
	Unit 2.2– Study the Drawing and Production Plan	15
	Unit 2.3 – Study the Coating Required	17
3	<b>Pretreat the Section to be Coated (PCS/N5106)</b>	<b>21</b>
	Unit 3.1 – Pretreatment Process	23
	Unit 3.2 – Know Company's Policy and Work Instructions on Quality Standards	33
4	<b>Perform Powder Coating (PCS/N5109)</b>	<b>38</b>
	Unit 4.1 – Powder Coating Application	39
	Unit 4.2– Check Quality of Powder Coated Components	47
	Unit 4.3– Cure the Coated Components	53
	Unit 4.4– Pack and Despatch	57
5	<b>Maintain Jigs, Tools and Machines (PCS/N5108)</b>	<b>61</b>
	Unit 5.1 – Maintain Pretreatment Baths, Coating Booth & Oven	63
	Unit 5.2 – Maintain Powder Coating Equipment, Facility & Jigs	72
6	<b>Coordinate with Colleagues and/or Customers (PCS/N9901)</b>	<b>79</b>
	Unit 6.1 – Understand Product/Service Quality Requirements of the Customer	81
	Unit 6.2 – Communicate with Colleagues Effectively	90
	Unit 6.3 – Achieve Customer Satisfaction	96
7	<b>Maintain Standards of Product/Service Quality (PCS/N9902)</b>	<b>101</b>
	Unit 7.1 – Understand Product/Service Quality Requirements	103
	Unit 7.2 – Achieve Quality Standards (Tests and Defects )	109



8	Maintain OH&S Standards and Follow (PCS/N9903)	119
	Unit 8.1 – Health Hazards of Powder Coating Materials	121
	Unit 8.2 – Use Safety Tools and Personal Protective Equipment	128
	Unit 8.3 – Handling of Powder Coating Materials and Equipment	130
	Unit 8.4 – Precautionary Measures	137
9	IPR of Organisation and Customers (PCS/N9904)	145
	Unit 9.1 – Secure Company’s IPR	147
	Unit 9.2 – Respect Customer’s Copyright	152
10	Annexures	157
	Annexure I: Training Delivery Plan	158
	Annexure II: Assessment Criteria	163
	Annexure III: Glossary	171





**Skill India**  
कौशल भारत - कुशल भारत



सत्यमेव जयते  
GOVERNMENT OF INDIA  
MINISTRY OF SKILL DEVELOPMENT  
& ENTREPRENEURSHIP



N.S.D.C.  
National  
Skill Development  
Corporation

Transforming the skill landscape

**PAINTS AND  
COATINGS  
SKILL COUNCIL**



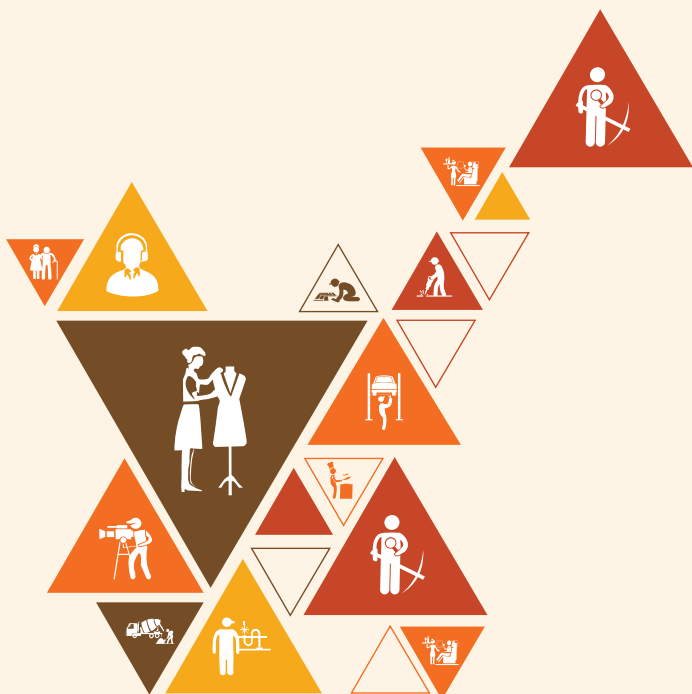
# 1. Introduction

Unit 1.1 – Icebreaker

Unit 1.2 – Objectives of the Program

Unit 1.3 – Paints and Coatings Sector in India

Unit 1.4 – Career Progression



## Key Learning outcomes

At the end of this module, you will be able to:

1. Build rapport with the fellow participants in the program.
2. Discuss paints and coatings sector in India and its sub-sectors.
3. Define your roles and responsibilities.
4. Explain how to prepare a part or an article for powder coating.
5. Explain and demonstrate the process of powder coating a surface or an article.
6. Explain and demonstrate how to maintain tools, equipment and materials required.

## UNIT 1.1: Icebreaker

### Unit Objectives

At the end of this unit, you will be able to:

1. Name your fellow participants and provide brief details about them.
2. Build rapport with the fellow students and trainers.

### Resources to be Used

- White board, marker, pen, notebook.
- A midsize play ball or any other prop which can be passed on.

### Say

- Welcome to the training programme on powder coating. I am privileged to be your trainer for the programme.
- This training programme aims to impart knowledge, skills and know-how on powder coating application. The objective is to enable you to get a job as powder coater after successful completion of the programme.
- Before we start the programme let's play a small game.
- Appreciate the students for their participation and say "did you enjoy the activity? What did you learn about each other? etc."

### Do

- Make the students stand in a circle close enough to pass a small ball to each other quickly.
- Say 'Stop' when the students least expect it. The person who has the ball at that time should get out.
- Those who get out should introduce themselves by providing their names and some additional information such as hobbies, likes, dislikes etc.
- The winner of the game should stand and introduce himself/herself at the end of the game.
- Award the winner a token of appreciation like a chocolate or a small gift.

## Notes for Facilitation

- Use energetic and positive body language and voice tone to energise and enthuse the students and set the tone for the day.
- After welcoming the students to the programme introduce yourself.
- You could ask the students who get out during the game to be the music keepers. They can start and stop the music as the game progresses.
- Encourage shy students to provide information about themselves by prompting them with questions such as 'what do you enjoy doing the most', 'what is your favorite movie or book', 'who is your role model' etc.

## UNIT 1.2: Objectives of the Course

### Unit Objectives

At the end of this unit, you will know:

1. What you would learn in the 30-day course on powder coating.
2. How you will be assessed at the end of the program.
3. The certification pass/fail criteria for successful completion of the program.

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- I would like you to tell me what your expectations are from the programme. Please feel free to say whatever comes to your mind first.
- I would like to give you an overview of the programme, what you will learn during the next 30 days and how you would be assessed at the end of the programme.

### Explain

- The objectives of the complete programme.
- Course overview.
- Assessment criteria.
- Certification pass/fail criteria.
- Attendance requirement to be eligible for certification.

### Notes for Facilitation

- Find out from the students what their expectations are from the course.
- List the expectations on the whiteboard.
- Relate their expectations with the objectives of the course.
- Give the overview of the complete program.

## Ask



- What are your expectations from this training program?
- Is there anything special that you want to learn from this program?

## UNIT 1.3: Paints and Coatings Sector in India

### Unit Objectives



At the end of this unit, you will know:

1. Explain what paints and coatings are.
2. Describe the classification of paints into different types.
3. See where powder coatings fall in the total coating sector.
4. Understand the subsectors in the industry and the types of jobs available to a powder coater.
5. Understand what powder coating is.
6. Understand what a powder coater does.

### Resources to be Used



- White board, marker, pen, notebook.

### Say



- Powder coating today is the youngest of the surface finishing techniques in common use.
- It is a dry paint product applied to a part.
- The success of powder coating is the result of its excellent properties, economy and environmental advantages over traditional solvent based liquid paints. Over the years many of the disadvantages that powder coatings suffered from have been eliminated or minimised through formulation improvements and developing better equipment. This will assure that the powder coating market will continue to grow at an impressive rate.
- The advent of low curing temperature systems, such as IR cured powders, has significantly opened the market to heat sensitive substrates such as wood, plastics, and assembled components with heat sensitive details.

### Notes for Facilitation



- You could ask the students what they know about the paints and coating industry in India,
- Encourage students to give examples of painted and powder coated products from everyday life and give the students some time to think about how the industry has changed over time from liquid paint to dry paint.
- Set the context and describe the industry trends in paints and coating.
- List fast-growing sub-sectors in paints and coating industry.

## Ask



- Can you think and name a few objects from your daily life which are painted or powder coated?
- Do you know someone in your family or friends' circle who is a painter/powder coater?

## Summarize



- Can you think and name a few objects from your daily life which are painted or powder coated?
- Do you know someone in your family or friends' circle who is a painter/powder coater?



## UNIT 1.4: Career Progression

### Unit Objectives

At the end of this unit, you will know:

1. Explain the significance of the job role of a powder coater.
2. Identify and explain the roles and responsibilities of a powder coater.
3. Describe the career path of a powder coater.

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- Let us understand what a powder coater does in the workplace.
- I will explain you the roles and responsibilities of a job coater if you choose to become an entrepreneur in later years.

### Ask

- What are the roles and responsibilities of a powder coater when the person is working in a factory setting?
- What are the roles and responsibilities of a powder coater when the person is working as an entrepreneur?

### Explain

- A typical day in the life of a powder coater.
- The roles and responsibilities of a powder coater in a factory setting.
- The organisation and reporting structure for the powder coating application companies with examples.
- The role of a powder coater in a small job-coating establishment.
- The roles and responsibilities of a powder coater as an entrepreneur and the difference between working as an employee and as an entrepreneur.
- The career path of a powder coater.
- The remuneration and perks of a powder coater.

## Explain



- The earning possibilities if one chooses to be an entrepreneur.
- Companies where a powder coater can be placed after the completion of the 30-day training program.
- The assistance which would be provided by the training partner in terms of placing the trainee.

## Notes for Facilitation



- Use energetic and positive body language and voice tone to energise and enthuse the students.
- Give an overview of the job role of a powder coater in a factory setting and in a job coating shop.
- Give an overview of the job role of a powder coated as an entrepreneur.
- Give them information on job opportunities owing to the current existing skill gaps in the market.
- Motivate the students to make the best use of the training program to learn technical, functional and behavioral skills and knowledge which can help them to earn their livelihood.

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.



**Skill India**  
कौशल भारत - कुशल भारत



सत्यमेव जयते  
GOVERNMENT OF INDIA  
MINISTRY OF SKILL DEVELOPMENT  
& ENTREPRENEURSHIP



N · S · D · C  
National  
Skill Development  
Corporation

Transforming the skill landscape

**PAINTS AND  
COATINGS  
SKILL COUNCIL**

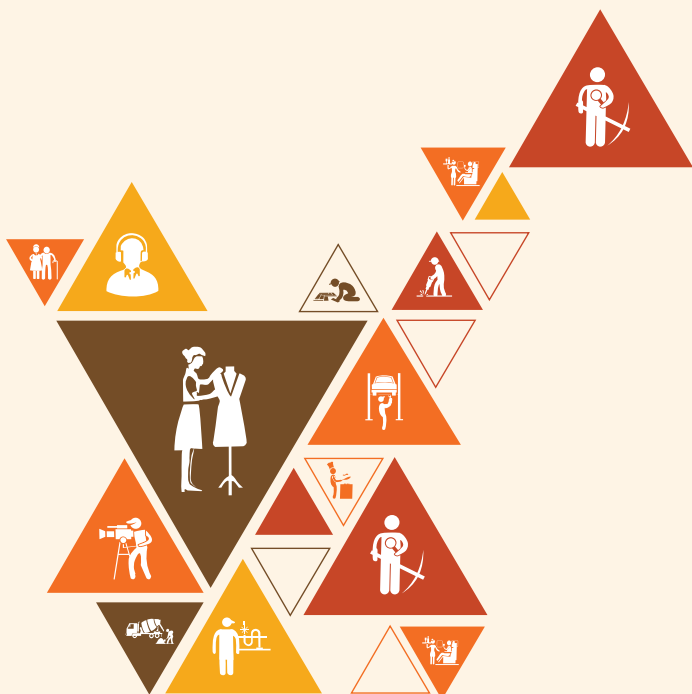


## 2. Prepare for Coating

Unit 2.1 – Basics of Powder Coating

Unit 2.2 – Study the Drawing and Production Plan

Unit 2.3 – Study the Coating Required



## Key Learning outcomes

At the end of this module, you will be able to:

1. Describe basic concepts, characteristics, and uses for powder coating.
2. Compare powder coating with solvent based paints and list its advantages and limitations.
3. Study and understand the production plan.
4. Identify various types of finish in powder coating.
5. Explain how to prepare jigging.

## Unit 2.1: Basics of Powder Coating

### Unit Objectives

At the end of this unit, you will be able to:

1. Explain advantages and limitations of powder coating and its uses.
2. Describe the components of powder coating and the paint chemistry.
3. Explain the manufacturing process for powder coating and quality control at each stage.

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- Powder coating is a solvent free dry paint material applied to a part.
- Powder coating is applied by either of two techniques – I) the part is lowered to a fluidised bed of powder which may or may not be electrostatically charged. II) The powder is electrostatically charged and sprayed onto the part. The part is then placed in an oven for curing where the powder particles melt and form a continuous film.
- There are two main types of powder available for surface finishing; Thermoplastic powders that will remelt when heated and Thermosetting powders that will not remelt upon reheating.
- The main advantage of powder coating is powder recovery for reuse, which results in less wastage. Electrostatic application ensures that powder is deposited in corners and crevices, improving the durability of the painted article.
- The main disadvantage of powder coating is it can have inferior leveling compared to liquid coatings (more orange peel) and curing is typically more energy intensive than liquid paint drying due to higher temperature requirements.
- Per Bureau of Indian Standards, the powder should be stored in a cool and dry place at a temperature not exceeding 25°C and at a relative humidity not more than 65 percent. Direct exposure of the powder to heat or sunlight must be avoided. The storage life of powders under above conditions will not be less than 6 months.

### Explain

- Where powders are used with everyday examples.
- Types of powders and their uses.
- Advantages and limitations of powder coating.
- Compare powder coating Vs. liquid painting.

## Explain



- Where powders are used with everyday examples.
- Types of powders and their uses.
- Advantages and limitations of powder coating.
- Compare powder coating Vs. liquid painting.

## Notes for Facilitation



- You can ask the students if they can identify objects in their everyday life where powder coating is applied and make a list on the whiteboard before introducing the section 'where powder is used'.
- You can divide the class in pairs to discuss about powder coating Vs. liquid coating. Invite few students to discuss in front of the class.
- After you explain the powder manufacturing process invite volunteers who can draw the stages on the whiteboard. Invite a few students from the class to explain the stages one at a time. Encourage participation by appreciating students who volunteer to come in front of the class.

## Ask



- What do you understand by powder coating?
- Why is powder coating known as green technology?
- What are the advantages of powder coating?
- What are the limitations of powder coating?
- Can you compare powder coating with liquid painting?

## Do



- Divide the class into two groups and instruct one group to discuss about the advantages of powder coating and the other group to discuss about its limitations.
- Explain the purpose and duration of the discussion.
- Set guidelines pertaining to rules, discipline and expected tasks.
- Ask the group representatives to make a short presentation in front of the class.

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

## Unit 2.2: Study the Drawing and Production Plan

### Unit Objectives



At the end of this unit, you will know:

1. Explain the drawing and production plan for powder coating.
2. Describe the customer specifications for powder coating.

### Resources to be Used



- White board, marker, pen, notebook.

### Say



- It is important to study the production plan and be aware of all the elements of production in your company.
- You must understand clearly the company standards and customer specifications for powder coating.
- There are two types of coating operations designated as “batch-type” and “conveyorised” productions.
- For the batch type coating, articles are jigged and hung on a fixed or rotatable jig-holder. The manual coater coats the components from all sides. The articles are then moved onto an oven trolley (or directly into the oven). The trolley, if used, is rolled into the oven when full. At the end of the curing schedule, the trolley is rolled out of the oven and allowed to cool. The articles are then moved out of the paint-shop.
- For conveyorised coating system articles are jigged and loaded onto the continuously moving overhead conveyor. As the conveyor moves the articles through the coating booth, they are coated on all sides by manual and/or automated spray guns. The conveyor then carries the articles into the tunnel oven (or in a semi-automated version, the articles are offloaded for off-line curing). At the end of the curing schedule, the article moves out of the oven (or the trolley is rolled out of the oven) and allowed to cool through a cool-off zone. The articles are then removed from the conveyor and taken out of the paint-shop.

### Explain



- The meaning, purpose and importance of drawing and production plan.
- The importance of following Standard operating procedure and processes of the company.
- Company quality standards and specifications for coating.
- Customer quality standards and specifications for coating.
- Batch type and conveyorised production methods.
- Purpose, importance and preparation for jigs and racks.

## Notes for Facilitation

- Find out from the students what they understand from drawing and production plan.
- Give the overview of the production process for powder coating.
- List the equipment, machines and tools used for powder coating.
- Give examples to explain the production processes and systems.

## Ask

- Have you ever been to a factory where production or manufacturing is done?
- Do you know anyone who works in a factory or a powder coating production unit?
- Why do you think it is important to follow the company quality standards and processes?
- Have you ever followed rules and processes of an organisation? If yes can you describe the situation and your learning from it.

## Do

- Divide the class in small groups (3-4 students) and instruct them to discuss the importance of studying the design plan, colour and finish specifications before powder coating application.
- Explain the purpose and duration of the discussion.
- Set guidelines pertaining to rules, discipline and expected tasks.
- Ask the group representatives to make a short presentation in front of the class.

## Summarize

- You can recap by asking participants to recall the key points. Thereafter, summarise the section.



## Unit 2.3: Study the Coating Required

### Unit Objectives



At the end of this unit, you will know:

1. Explain the basic concepts of colour.
2. Describe the colour and finish specifications of the customer.
3. Describe the types of finish in powder coating.

### Resources to be Used



- White board, marker, pen, notebook,
- Colour sketch pen/water colour, colour wheel/disc.
- Sample cards for various types of finish in powder coating.

### Say



- Colour is the product of wavelengths that are either absorbed or reflected by the surface of an object.
- Newton through his various experiments proved that light is the source of all colours. His discoveries proved that white light is a compound of all colours and that all colours in the spectrum are present in white light. With further experimenting, Newton discovered that the colour of an object is determined by selective reflection of light rays. When light strikes an object, some light rays are absorbed and lost. Some light rays are reflected to produce the observed object colour.
- Without light, there is no colour. Total darkness is void of all colour. We see the colours produced by an object only when it is bathed in light.
- Red, Yellow and Blue are called primary colours. They cannot be obtained by mixing together other colours.
- Orange, green and violet are called secondary colours. They are obtained by mixing, in equal amounts, two adjoining primaries. Orange results from the mixing of red with yellow. Green results from the mixing of yellow with blue. Violet results from the mixing of blue with red.
- When the primaries are not mixed in equal amounts, intermediary colours are formed, such as yellow-green (chartreuse), green-yellow (apple green), etc.
- Tertiary colours are obtained by mixing together two secondary colours, such as orange with green (olive), green with violet (slate) or violet with orange (russet).
- Colours that appear opposite from each other on the colour circle are called complementary colours.
- Warm colours are those of the fire and sun: reds, yellows, oranges and red violets.
- Cool colours are those of ice and the oceans: Blues, blue-greens, & blue-violets.

## Explain



- Concept of colour and colour wheel.
- Primary colour, secondary colour and tertiary colour.
- Complimentary colours in the colour wheel.
- Warm colours and cool colours.
- Colour standards with examples.
- What is meant by 'finish' in paint trade?
- Types of finish in powder coating with examples.

## Demonstrate



- Primary, secondary, tertiary and complimentary colours in a colour wheel. Make the students participate in the demonstration.
- Sample cards for various types of finish in powder coating. Make it a fun activity by asking students to identify the type of finish for each card.

## Notes for Facilitation



- Find out from the students what their favorite colours are and why.
- Give the overview of colour theory and colour standards.
- Give the overview of surface finish required for powder coating and different types of finish.
- Relate their everyday knowledge about colours to different types of colours – primary, secondary, tertiary and complimentary.
- Explain with everyday examples which the students can easily relate to.
- You could bring colour sketch pens/water colour to the class to practically demonstrate primary, secondary, tertiary and complimentary colours.

## Ask



- Can you identify and name objects in nature with primary colours?
- Can you identify and name objects with secondary colours?
- Can you identify and name objects with tertiary colours?
- Can you tell the reasons when and why two colours are mixed? What purpose is achieved by mixing of colours?
- Name three household objects for which warm colours are preferred?
- Name three household objects for which cool colours are preferred?

## Do

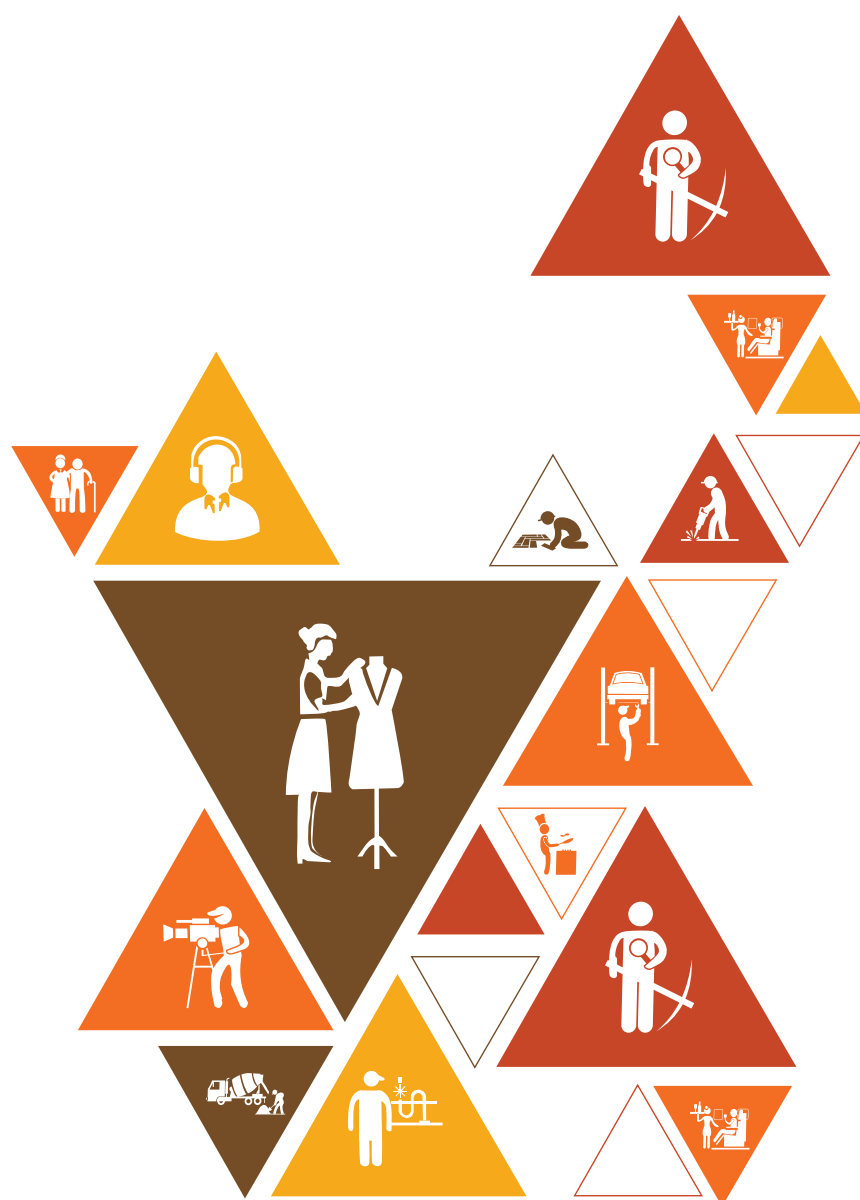


- Divide the class in small groups (3-4 students) and instruct them to discuss the colour theory and colour standards and the importance of knowledge of colour for powder coating application.
- Explain the purpose and duration of the discussion.
- Set guidelines pertaining to rules, discipline and expected tasks.
- Ask the group representatives to make a short presentation in front of the class.

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.



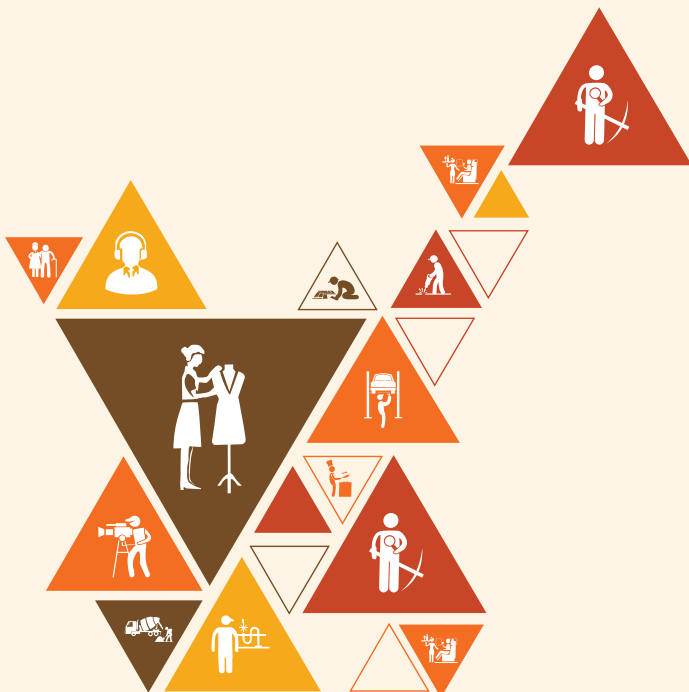
**PAINTS AND  
COATINGS  
SKILL COUNCIL**



## 3. Pretreat the Section to be Coated

Unit 3.1 – Pretreatment Process

Unit 3.2 – Know Company's Policy and Work Instructions  
on Quality Standards



## Key Learning outcomes

At the end of this module, you will be able to:

1. Describe the pretreatment process for powder coating.
2. Follow company's policy and work instructions on quality standards.

## Unit 3.1: Pretreatment Process

### Unit Objectives



At the end of this unit, you will be able to:

1. Explain the importance of pretreatment before powder coating.
2. Describe the pretreatment process flow.

### 3.1.1 Powder Coating Facility Process Flow Diagram

#### Resources to be Used

- White board, marker, pen, notebook.
- Powder coating facility process flow diagram.

#### Say

- The highest quality powder coating will show excellent results only if the pretreatment is done correctly and the overall system is maintained up to its potential.
- It is important that the pretreatment system can provide a clean conversion coated product in a dry state to the powder booth.
- A thorough understanding of the total system of powder coating is necessary to begin with.
- In a typical powder coating line, there are many stages that the job moves through from part loading to final inspection.
- Now let us understand the powder coating facility through a process flow diagram.

#### Explain

- The process flow diagram and the total process with stages.

#### Notes for Facilitation

- Give the overview of the powder coating facility and its processes.
- Explain how the part moves from one stage to the other till it reaches the inspection stage.
- After you explain the process flow diagram and the stages to the class, invite volunteers who can draw the stages on the whiteboard. Invite few students from the class to explain the stages one at a time.

#### Ask

- Have you even been to a factory? If yes can you describe your experience?
- Have you ever been to a powder coating facility?
- Can you compare powder coating facility with any other factory setting?

#### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.



## 3.1.2 Pretreatment Methods

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- Surface preparation before powder coat application is still critical for good adhesion and defect avoidance. The basis of any good coating is preparation. The majority of failures in powder coating can be traced to a lack of a suitable preparation. There are different treatments available for different materials.
- The highest quality powder coating will show you excellent results only if the pretreatment is done correctly and the overall system is maintained up to its potential.
- Pretreatment is done primarily to remove foreign matter from the surface and condition the surface to make it suitable for optimal quality coating.
- There are two methods of pretreatment, mechanical and chemical. Selecting a pretreatment method will depend on the type and shape of articles, corrosion resistance requirements, etc.
- Mechanical pretreatment is preferred for hot rolled steel and castings.
- Chemical pretreatment is preferred for cold rolled sheets and HR pickled materials.
- The articles to be coated are first cleaned to remove all foreign matter from the surface. Mild steel components go through a phosphate conversion coating. Aluminum components go through a chromate conversion coating.
- The major problems during pretreatment are parts not clean, flash rusting due to parts drying during the process, poor maintenance/control of the chemical and rinse baths.

### Explain

- Plant layout for a powder coating line.
- Different types of pretreatment methods.
- Mechanical pretreatment methods and tools.

### Notes for Facilitation

- Give the class an overview of a powder coating plant layout.
- Show real pictures, illustrations and videos of a powder coating plant.
- Show pictures and videos of mechanical pretreatment methods and tools used for it.

## Ask



- Why is pretreatment required before powder coating?
- How is a pretreatment method selected?
- What are some of the mistakes which should be avoided during pretreatment?

## Summarize



- You can recap by asking participants to recall the key points and then summarising the section.

### 3.1.3 Importance of inspecting the substrate before pretreatment

#### Resources to be Used

- White board, marker, pen, notebook.
- Part/article for pretreatment.
- Solvent wipe.
- Spray bottles for water break test.
- Testing materials for Blotter test and Vial test.

#### Say

- Powder requires a clean surface. The benefit of powder can be maximised through a good pretreatment process and quality.
- Thorough inspection and testing is required before an article is taken up for pretreatment. The inspection is for weld defects, sharp edges, spatters, oil, grease etc.
- Common weld defects are lack of fusion, lack of penetration or excess penetration, porosity, inclusions, cracking, undercut and lamellar tearing.
- The sharp edges are mechanically weak and can lead to edge chipping and water breakage. The process of edge grinding strengthens the edge of the substrate and minimizes edge flaking. Edge grinding can be an effective method for addressing the slight “out of round” nature of substrates.

#### Explain

- The problems and defects in a part which need to be addressed before pretreatment.
- Different types of tests and the procedures to carry out the tests which are conducted before pretreatment.

#### Demonstrate

- How to clean the part with solvent. Involve the students in the demonstration activity.
- Water break test procedure. Involve the students in the demonstration activity.
- Blotter test procedure. Involve the students in the demonstration activity.
- Vial test procedure. Involve the students in the demonstration activity.
- Divide the class in small group of 4-5 students while demonstrating different tests and cleaning procedures. Give clear instructions and adequate explanation for each step during demonstration. Invite the students in the group to demonstrate one by one and give feedback after each demonstration.

## Notes for Facilitation

- Show them real pictures. Illustrations and videos of weld defects, sharp edges, spatters, oil and grease on the part
- Show them pictures and videos of different types of tests before pretreatment.

## Ask

- Why inspection of the part is required before pretreatment?
- What are the problems and defects you should look for in a part before pretreatment?
- Once you detect defects in the part what should be your course of action?

## Do

- Divide the class in small groups (3-4 students) and instruct them to discuss about varieties of problems and defects which can be there on the part before and after the pretreatment.
- Explain the purpose and duration of the discussion.
- Set guidelines pertaining to rules, discipline and expected tasks.
- Ask the group representatives to make a short presentation in front of the class.

## Summarize

- You can recap by asking participants to recall the key points and thereafter summarizing the section.

### 3.1.4 International Standards

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- A standard is a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose.
- SSPC: The Society for Protective Coatings was founded in 1950 as the Steel Structures Painting Council, a non-profit professional society concerned with the use of coatings to protect industrial steel structures
- SSPC coating material standards contain requirements for the performance of various types of coatings when tested in accordance with industry-established laboratory and field standards.
- NACE International is a professional organization which was established in 1943 for the corrosion control industry.
- NACE's focus of activities includes cathodic protection, coatings for industry, inspection, corrosion testing, and material selection for specific chemical resistance.
- NACE also publishes standard practice, test method, and material requirements standards for use by industry and other Corrosion societies. Standing committees periodically review and update the standards every five years.
- ISO (International Organization for Standardization) ISO has over 21000 International Standards covering almost all aspects of technology and business.
- ISO International Standards ensure that products and services are safe, reliable and of good quality. For business, they are strategic tools that reduce costs by minimizing waste and errors, and increasing productivity.

#### Explain

- The need and importance of a standard
- SSPC
- NACE
- ISO

## Notes for Facilitation

- Give the overview of the international standards for powder coating.
- Discuss the importance of following standards.
- How following international standards can help improve productivity and customer satisfaction.

## Ask

- What are the international standards for powder coating?
- Why is it important to follow the standards in powder coating application?

## Summarize

- You can recap by asking participants to recall the key points and thereafter summarizing the section.

### 3.1.5 Chemical Pretreatment

#### Resources to be Used

- White board, marker, pen, notebook.
- Chemical pretreatment set up.
- Burette, pipette, conical flask, beakers, pH papers.
- Chemical Reagents like 0.1 N H<sub>2</sub>SO<sub>4</sub>, 0.1 N NaOH, Methyl orange and Phenolphthalein as indicators.

#### Say

- Surface preparation before powder coat application is critical for adhesion and defect avoidance. The basis of any good coating is preparation.
- The chemical surface preparation selected is closely related to the nature of the surface being cleaned and the nature of the contamination. The process can be either dip or spray. In a dip process, the components are dipped in a tank containing the chemical solution, while in a spray process, the chemical solution is sprayed on the component.
- Pretreatment is employed for improved bonding of the powder coat to the material being coated and thus to provide a longer life to the coat.

#### Explain

- Each stage of the chemical pretreatment process.
- Factors to be considered for pretreatment process.
- Pretreatment process control chart.
- Major problems during pretreatment.
- Troubleshooting guidelines.
- Chromatising process.

#### Demonstrate

- Each stage of the chemical pretreatment process.
- Divide the class in small group of 4-5 students while demonstrating. Give clear instructions and adequate explanation for each step during demonstration.

## Notes for Facilitation

- Give the overview of the chemical pretreatment process.
- You can divide the class in pairs to discuss about each stage of the chemical pretreatment process. Invite a few students to discuss in front of the class.
- After you explain the pretreatment process to the class invite volunteers who can draw the stages on the whiteboard. Invite a few students from the class to explain the stages one at a time.

## Summarize

- You can recap by asking participants to recall the key points and thereafter summarizing the section.



## Unit 3.2: Know Company's Policy and Work Instructions on Quality Standards

### Unit Objectives



At the end of this unit, you will be able to:

1. Explain the importance of company's policy and work instructions to ensure quality standards are maintained.
2. Describe how to follow Standard Operating Procedure for pretreatment process.

### 3.2.1 Importance of Company's Policy and Work Instructions to Ensure Quality Standards

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- A company defines its policy and quality standards to achieve quality performance consistently.
- Based on the quality standards and customer specifications a Standard Operating Procedure is generated with specific work instructions.

#### Explain

- The meaning and importance of company policy.
- The meaning and importance of quality standards.
- The meaning and importance of Standard Operating Procedure.
- The meaning and importance of Industry regulations and legal requirements.

#### Notes for Facilitation

- Find out from the students what they understand by company policy and quality standards.
- Give the overview of the production process for powder coating and sample Standard Operating Procedure for a powder coating line.
- Give examples to explain the concept.

#### Ask

- What do you understand by quality standards?
- What do you understand by customer specifications?
- Why is it important to follow the quality standards of the company?
- What are the consequences of not meeting customer specifications?

#### Summarize

- You can recap by asking participants to recall the key points and thereafter summarizing the section.

### 3.2.2 Follow SOP for pretreatment process

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- Standard Operating Procedure or SOP, is a set of step-by-step instructions compiled to help workers carry out routine operations. It aims to achieve efficiency, quality output and uniformity of performance, while reducing miscommunication and failure to comply with quality regulations. SOP is a detailed, written set of instructions to achieve uniformity of the performance of a specific function.”
- Following SOP ensures consistency in the process.
- Following SOP help maximize safety and operational efficiency.
- New employees use an SOP to answer questions without having to interrupt supervisors to ask how an operation is performed.
- SOP is the base for the everyday training program of every employee.

#### Notes for Facilitation

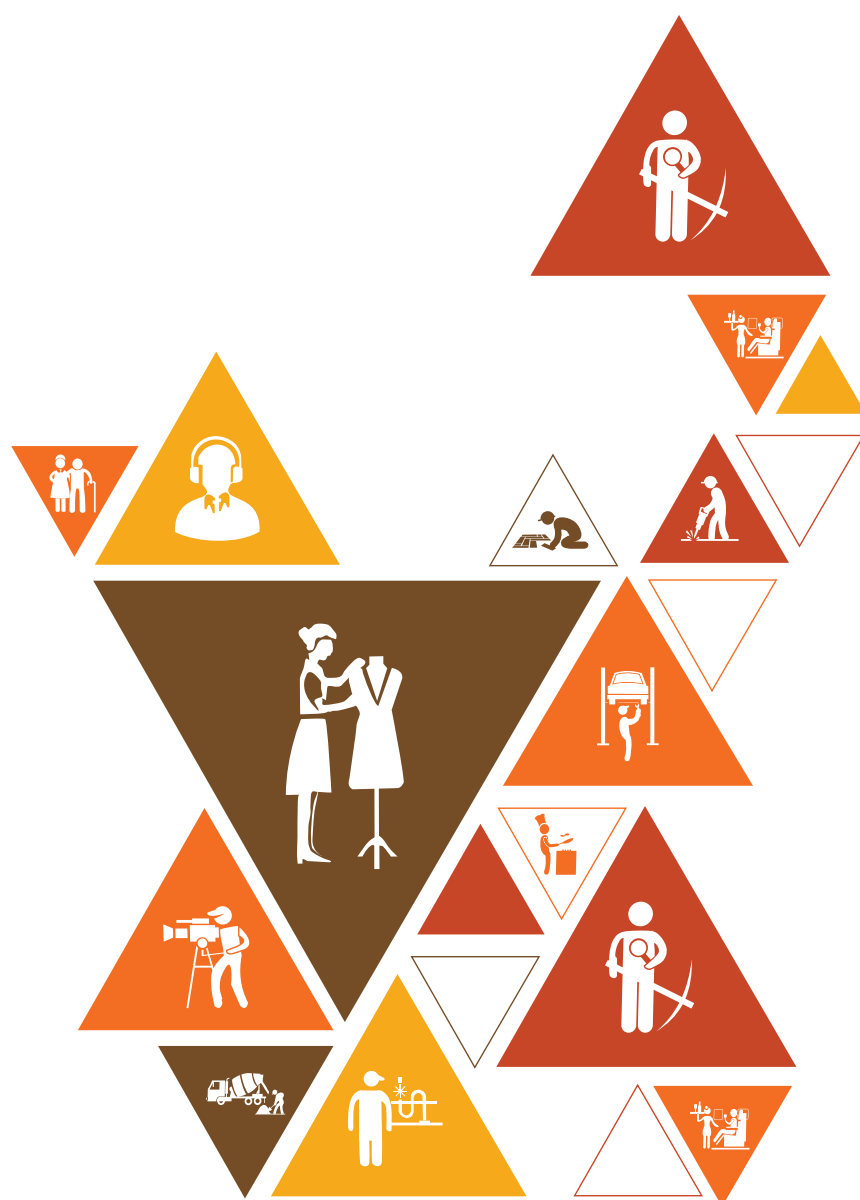
- Find out from the students what they understand by ‘Standard Operating Procedure’ or SOP.
- Give the overview of the production process SOP followed by a powder coating factory.
- Give examples to explain the production process SOP.

#### Ask

- What do you understand by a Standard Operating Procedure?
- Why should an SOP be followed by every employee?
- Can you think of the consequences of not following an SOP for a powder coating line?

#### Summarize

- You can recap by asking participants to recall the key points and thereafter summarizing the section.





## Key Learning outcomes

At the end of this module, you will be able to:

1. Describe the application process for powder coating.
2. Follow guidelines to check quality of powder coated components.
3. Describe the process of curing the coated section.
4. Care to be taken during Packing & Assembly.

## Unit 4.1: Powder Coat the Sections

### Unit Objectives



At the end of this unit, you will be able to:

1. Explain the process flow for powder coating.
2. List the powder coating equipment.
3. Describe the powder recovery systems.

### 4.1.1 Powder Coating Application Process

#### Resources to be Used

- White board, marker, pen, notebook.
- Powder coating equipment.

#### Say

- The powder coating process is like a painting process, except that the “dry” powder is used instead of “liquid” paint. In an electrostatic application, the charged powder particles are attracted to the parts which are earthed or ground, thereby coating the part. Any conductive substrate that can withstand the high temperature curing of the powder coat, can be coated. The powder melts, flows and levels out during the curing process.
- Three commonly used methods of charging the powder during application are corona method, tribo charge and fluidised bed method.
- In corona charging, a high voltage potential is developed at an electrode located near the powder stream. An ion field is generated between the electrode and the grounded product. Powder particles passing through this field become charged and are attracted to the grounded product. The charged particles accumulate on the grounded product that are electrostatically retained long enough for the product to pass through a curing oven. The placement of the charging electrode in relationship to the powder stream is critical in achieving effective powder charging. Two of the most typical nozzles are deflectors which create a round spray cloud and fan spray which create a flat spray cloud.
- The charging of the powder particles in a tribo gun is achieved by the friction of two dissimilar materials coming in contact with one another. In case of most tribo guns the electrons are stripped from the powder particles as they make contact with the gun wall. This results in the particle giving up electrons which leaves it with a net positive charge. The powder particles accumulate on the grounded product and are attached long enough for the product to pass through a cure oven. Teflon is typically the material used in the gun because of its ability to accept and discharge electrons and its wear characteristics. Because teflon is on the negative end of the table, materials at the positive end are the most successfully used as tribo powders.
- In fluidised bed powder coating, heated parts are either dipped directly into a container of fluidised powder or passed through an electrically charged cloud of powder, which is created above a container of fluidised powder. Fluidised bed coating generally applies a thicker coating. Unlike electrostatic coating, fluid bed coating will generally smooth over any small details in the parts, such as embossed serial numbers, metal imperfections, etc. This can be extremely beneficial for parts where Faraday Cage effects are problematic.



## Demonstrate

- Powder coating equipment like Corona gun, Tribo charging gun, powder booth and hopper.
- How to set controls of spray gun movements.
- How to set sensors to ensure uniform powder delivery rate.
- How to set conveyor speed.
- How to adjust the pressure on the fluid container and size of fluid orifice.
- Powder coating application process.

## Notes for Facilitation

- You could divide the class into small groups of 3-4 students to give demonstration.
- You could show videos of powder coating application for common method of applying powder coating before actual demonstration.

## Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 4.1.2 Process Flow Chart for Powder Application

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- You can recall that we have learnt about the processes followed in a powder coating factory in the previous module.
- Part loading – First the part to be coated are loaded and readied for pretreatment.
- Pretreatment – all parts are processed through the pretreatment stages.
- Quality control: Parts are checked after they leave the pretreatment stage for proper and uniform chemical conversion coating. Parts are also checked for trapped water in box sections and compressed air is used to remove any excess water.
- Dry off oven: Parts are put through dry off oven to remove any moisture that might remain.
- Manual booth: Dual manual spray booth allow capacity for unlimited colour changes during a shift. Dual spray guns can be used in these manual spray booths and this gives efficiency to finish medium size orders at volume pricing.
- Automatic booth: Automatic spray booth gives a competitive edge when pricing large volume projects.
- Curing oven: The parts are baked to achieve a durable quality finish. Baking times and temperatures will differ based on the type of powder and the thickness of the metal.
- Final inspection: As parts are being unloaded final quality checks are done to ensure product quality. Parts are checked for coverage, appearance, colour, gloss, thickness of coating, adhesion and cure.

### Notes for Facilitation

- Give the students a description of the standard process followed in a powder coating line.
- You could invite students to draw the powder coating process flow chart on the board. Invite few students to explain the various stages of the process.
- You could show videos of standard process of production followed in a powder coating line.
- Encourage the students by appreciating them for their participation. Heartily applaud those who can recall the process and can explain the stages in the process.
- You can recap by asking participants to recall the key points and thereafter summarise the section.

### 4.1.3 Powder Coating Booth

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- A powder coating booth is an enclosure specifically designed for the powder application process. A recovery system is attached to the powder coating booth enclosure to reclaim the over spray powder.
- The size, number and style of powder booths needed depends on the component size and shape, the available space, and the production volumes. The component size and shape determines the height and width of the booth and the required product size opening.
- It is important to have good lighting inside the booth, especially for manual sprayers. Poor lighting can result into too much coating or not enough coating on the part.
- The spray booth must have negative air pressure to contain the powder inside the booth.
- The airflow inside the booth must not be too aggressive otherwise it would compete with the part for the powder.
- The reclaim system inlet must be large enough and located far enough from the spray zone to avoid any interference with the application process.
- For the batch type coating process, the articles are jigged and hung in the coating booth on a fixed or rotatable jig-holder. The manual coater coats the components from all sides. The articles are then moved out onto an oven trolley (or directly into the oven). The trolley, if used, is rolled into the oven when full. At the end of the curing schedule, the trolley is rolled out of the oven and allowed to cool down. The articles are then removed out from the paint-shop.
- For conveyorised coating system articles are jigged and loaded onto the continuously moving overhead conveyor. As the conveyor moves the articles through the coating booth, they are coated on all sides by manual and/or automated spray guns. The conveyor then carries the articles into the tunnel oven (or in a semi-automated version, the articles are offloaded for off-line curing). At the end of the curing schedule, the article moves out of the oven (or the trolley is rolled out of the oven) and allowed to cool down through a cool-off zone. The articles are then removed off the conveyor and taken out of the paint-shop.

#### Notes for Facilitation

- Give the students a description of the standard process followed for the powder coating application in a powder coating booth.
- You could show videos of different kinds of powder coating booth used in a powder coating line.

## Demonstrate

- Powder coating spray booth.
- Setting up of tools and equipment for powder coating.
- Cleaning the booth.

## Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 4.1.4 Recovery System

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- The function of a powder recovery system is to collect the overspray material and render it suitable for recycling and at the same time to remove the powder particles from the exhaust air stream before discharge into the atmosphere.
- There are two types of collectors viz. cyclone collectors and cartridge collectors.
- In cyclone collectors, the input to the cyclone is connected to the booth while the output is connected to a suitable exhaust fan. The overspray powder arrives at the cyclone inlet at a velocity of about 20 meters per second.

### Notes for Facilitation

- Give the students a description of different types of recovery system used in a powder coating booth.
- You could show videos of different kinds of recovery system used in a powder coating line.

### Demonstrate

- Cyclone type recovery system and cartridge type recovery system.
- How to operate a recovery system.

### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 4.1.5 Powder Coating Equipment

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- We will now learn about the powder coating equipment. Right equipment is essential for quality powder coating.
- The equipment used for powder application are spray gun, powder feed system, colour change system, recovery booth.
- Powder feed system - powder feed system supplies virgin powder directly from a fiber drum to a hopper/feeder in a continuous, efficient operation.
- Colour change system - colour change powder spray system is optimised for efficient, repeatable powder application and fast, contamination-free colour change.

### Notes for Facilitation

- Give the students a description of different types of powder coating tools and equipment.
- You could show videos of different kinds of tools and equipment used in a powder coating line.
- You could divide the class in small groups of 3-5 to demonstrate powder coating tools and equipment and how to operate them.

### Demonstrate

- How to operate different kind of tools and equipment.
- How to clean and maintain the equipment.

### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

## Unit 4.2: Check quality of powder coated sections

### Unit Objectives



At the end of this unit, you will be able to:

1. Explain the application problems in powder coating.
2. Describe the process to measure the dry film thickness using a DFT gauge.
3. Explain the steps to check the adhesion of the coating by the cross-hatch test.
4. Explain the criteria for visual check of colour and finish.
5. Compare the painted sections with the master sample provided.

## 4.2.1 Application Problems

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- There are problems which may arise due to the application of the powder like, dust particles, Orange peel, colour difference as compared to the standard, pin-holes, peel off.
- Dust particles could be due to poor housekeeping and poor air balance in the spray booth.
- Orange peel may occur due to several aspects most commonly poor particle size distribution and poor gun control.
- Colour difference may occur due to variation in the dry film thickness, poor oven conditions/ controls, overbaking and powder quality. There may be 'Hot spots' in the oven. All the jobs must have the same curing conditions.
- Pinholes observed on the coated surface may be the result of cross contamination or back ionization. To avoid this problem, the powder coating system must be thoroughly clean and the gun is at least 12 inches away from the work piece.
- Powder peel off occurs due to poor adhesion caused by poor substrate preparation or insufficient curing. It must be ensured that the substrate is suitably pretreated.

### Explain

- Poor charging.
- The Faraday cage effect.
- Back ionization.
- Surging of the powder.
- Inconsistent powder delivery.
- Air flow problems.
- Film build control.
- Cross contamination.

### Notes for Facilitation

- Give the students a description of different types of application problems in powder coating.
- You could show videos of different kinds of application problems commonly encountered in a powder coating line.



## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 4.2.2 Coated Film Thickness Measurement

### Resources to be Used

- White board, marker, pen, notebook.
- DFT measurement instrument.

### Say

- Dry film thickness can be measured on either magnetic metal surfaces (stainless steel) or non-magnetic metal surfaces (aluminium) using a coating thickness gauge. The principle of electromagnetic induction is used for non-magnetic coatings on magnetic substrates such as steel.

### Notes for Facilitation

- Give the students a description of how a dry film thickness (DFT) measurement is carried out.
- You could show videos of DFT measurement before doing the actual demonstration.
- You could divide the class in small groups of 3-5 to demonstrate how DFT is measured.
- You can recap by asking participants to recall the key points and thereafter summarise the section.

### Demonstrate

- DFT measurement process.
- Microns of thickness of powder coating using micro-meter.
- Visual check to see colour and finish of the powder coated part.

### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

### 4.2.3 Crosscut Test for Adhesion

#### Resources to be Used

- White board, marker, pen, notebook.
- Cross-cut test apparatus.

#### Say

- Crosscut test is often used to determine if the paint or coating will adhere properly to the substrates over which they are applied.
- There are three different tests to measure the adhesion of paints and coatings to different substrates: cross-cut test, scrape adhesion, and pull-off test. We will focus here on cross-cut test.
- The cross-cut test is a method for determining the adhesion of paints and coatings to the substrates by utilising a tool to cut a right-angle lattice pattern into the coating penetrating all the way to the substrate.
- There are two methods. Test method A - An X-cut is made through the film with a carbide tip tool to the substrate. Pressure-sensitive tape is applied over the cut. Tape is smoothed into place by using a pencil eraser over the area of the incisions. Tape is removed by pulling it off rapidly back over itself as close to an angle of 180°. Adhesion is assessed on a 0 to 5 scale (0- Greater than 65% area removed & 5 is 0% area removed).
- Test method B -A crosshatch pattern is made through the film to the substrate. Detached flakes of coating are removed by brushing with a soft brush. Pressure-sensitive tape is applied over the crosshatch cut. Tape is smoothed into place by using a pencil eraser over the area of the incisions. Tape is removed by pulling it off rapidly back over itself as close to an angle of 180°. Adhesion is assessed on a 0 to 5 scale (methodB is not considered to be suitable for coatings thicker than 5 mils).

#### Notes for Facilitation

- Give the students a description of how a cross-cut test for adhesion is carried out.
- You could show videos of cross-cut test before doing the actual demonstration.
- You could divide the class in small groups of 3-5 to demonstrate how cross-cut test is conducted.

#### Demonstrate

- Cross-cut test procedure.

#### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 4.2.4 Comparing Painted Section with the Sample

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- One way of visually testing the powder coated job is comparing the painted section with the master/ approved sample.
- There should not be a significant difference in the coating job and the master/ approved sample wrt colour and appearance.
- If a significant difference is observed between the coated job and the master/ approved sample, quickly find out root cause of the problem and rectify the same.

### Notes for Facilitation

- Give the students a description of how to visually compare the painted section with the master/ approved sample.
- You could show videos of how to compare colour and gloss with the master/ approved sample before actual demonstration.
- You could divide the class in small groups of 3-5 to demonstrate how to compare colour and gloss with the master/ approved sample.
- You can recap by asking participants to recall the key points and thereafter summarise the section.

### Demonstrate

- How to compare colour and gloss with the master/ approved sample.

### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

## Unit 4.3: Cure the Coated Section

### Unit Objectives



At the end of this unit, you will be able to:

1. Explain how to calibrate the oven.
2. Describe the steps to set conveyor in motion or use batch curing as per company's standards.

### 4.3.1 Powder Curing Process

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- The key to success of powder curing is maintaining the recommended curing time and temperature in the oven.
- Bake/cure process generally follows the coating is applied, there are instances when it is preferable to heat the substrate first.
- Normally the powders cure at 200 °C for 10 minutes. The curing schedule could vary per the manufacturer's specifications. The application of energy to the product to be cured can be accomplished by convection ovens, infrared ovens, or by laser curing process. The latter demonstrates significant reduction of curing time.

#### Notes for Facilitation

- Give the students a description of how curing is done for the coated jobs.
- You could show videos of the curing process before actual demonstration.
- You could divide the class in small groups of 3-5 to demonstrate how the curing is done in a running powder coating factory.

#### Demonstrate

- How to calibrate the oven temperature and time.
- Set conveyor in motion or use batch curing by moving sections inside the oven at temperature and for time as per company's standards.
- How to cure the coated parts.
- How to load and unload the part(s) in an oven.
- How to clean the oven.

#### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

### 4.3.2 Stages of cure

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- The final coating is continuous and will vary from high gloss to flat matt depending on the design of the powder by the supplier.
- The typical stages of cure are - Melt, flow, gel, cure, and finally the cured film.

#### Explain

- The curing stages.

#### Notes for Facilitation

- Give the overview of the powder curing stages.
- Give relatable examples to explain the curing stages.
- You could show the videos of powder curing stages.

#### Ask

- What are the issues you can think of during curing stages?

#### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

### 4.3.3 Bake Oven Design and Typical Energy Consumption

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- To get a dry powder coat film, we need high temperature to cure the powder coating. This is achieved using an oven that is capable of sustaining 450 degrees and the parts must fit inside of it.
- A broad range of industrial ovens and furnaces are used for curing/ baking the powder coating. These ovens have a provision of circulating heated air for curing the powder coat.

#### Explain

- Bake oven design and preparation for curing powder coating.
- Convection ovens.
- Conveyorised oven.
- Batch type oven.
- Infrared ovens.
- Ultraviolet cure ovens.
- Determinants of curing conditions.

#### Notes for Facilitation

- Give the students a description of different types of ovens and furnaces to cure the coated jobs.
- You could show videos of the bake oven design and preparation before actual demonstration.
- You could divide the class in small groups of 3-5 to demonstrate the bake oven design and preparation in a running powder coating factory.

#### Demonstrate

- Bake oven design and preparation.

#### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.



## Unit 4.4: Pack Parts and Despatch

### Unit Objectives



At the end of this unit, you will be able to:

1. Describe how to clean the sections to remove dust.
2. Explain the packing and despatch of the component.

### 4.4.1 Clean the section before packing

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- After the parts, have passed through the oven, the only thing left is to carry out a final inspection/ quality check.
- The defects and fine dust particles, if observed, are repaired by buffing and polishing.
- Remove masking, if any and properly pack for transit. Depending on the size, shape, weight and quantity of the parts, they are packed using a variety of packaging materials. All parts are carefully wrapped and packaged to prevent them from moving around during transit.

#### Explain

- Cleaning and buffing of the coated product.

#### Demonstrate

- Sand paper, buffing wheel, buffing paste.
- The process of cleaning and buffing.

#### Notes for Facilitation

- You could show the videos of how the finished product is cleaned before packing and dispatch.

#### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 4.4.2 Packing and Despatch

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- The dispatch team applies protective tape or film and packs the coated jobs for transit. High quality packaging materials are used to ensure safe passage of material. The product is interwoven with corrugated paper to prevent damage and may also be secondary wrapped in polythene. All products are then placed in a metal stillage lined with corrugated paper.
- Powder coating factories may follow the standard packing specifications of the company or can also discuss with the customer for customer specific packing requirements especially when the products must be shipped.

### Explain

- The importance of high quality packing.
- The packing and dispatch procedure followed by powder coating companies.
- Customer-specific packing.
- The relation between high quality packing and customer satisfaction.

### Demonstrate

- The packing and dispatch procedure followed by powder coating companies.

### Notes for Facilitation

- Give the overview of the packing and dispatch procedure.
- Give examples to explain the packing and dispatch of powder coated products.
- You could show the videos of packing and dispatch of the powder coated products.

### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.





## Key Learning outcomes

At the end of this module, you will be able to:

1. Describe how to maintain the pre-treatment baths.
2. Describe how to clean and maintain the powder coating booth and oven.
3. Explain the upkeep and maintenance for powder coating equipment, facility and jigs / hangers.

## Unit 5.1: Maintain Pretreatment Baths, Powder Coating Booth

### Unit Objectives



At the end of this unit, you will be able to:

1. Describe the maintenance of pre-treatment baths.
2. List the daily and monthly maintenance steps to clean the booth.
3. Describe the cleaning process during colour change.
4. Describe the maintenance schedule for bake oven.

## 5.1.1 Overall System Maintenance

### Resources to be Used

- White board, marker, pen, notebook

### Say

- Lack of system maintenance affects productivity and can result into costly downtime.
- An SOP document clearly defines all aspects of a maintenance plan. By following the SOP, it is possible to design a plan, schedule the activities, maintain a supply of the materials needed to keep the system operating properly.

### Explain

- The importance of overall system maintenance.
- The cost of production downtime because of system/ machine failure.
- Importance of following the maintenance SOP.

### Notes for Facilitation

- Give the students a description of overall system maintenance for a powder coating plant.
- You could show videos of system maintenance of a powder coating plant.

### Ask

- What could happen if the system in the powder coating plant is not maintained regularly?
- What could happen if every employee follows the maintenance SOP?

### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.



## 5.1.2 Pretreatment Bath Maintenance

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- Pretreatment baths need to be regularly checked for concentration, temperature, pH, conductivity, oil content and cleanliness.
- Chemical supplier should do a systematic sample audit on a regular basis by sending the bath sample to the chemical supplier's laboratory for analysis. This data is recorded and statistically analysed to produce sustainable quality.

### Explain

- Importance of pretreatment bath maintenance.
- How to check bath specifications such as concentration, temperature, pH, conductivity, oil content and cleanliness.
- Importance of sample audit by chemical supplier on a regular basis.

### Notes for Facilitation

- Give the students a description of different types of checks to be done for pretreatment bath maintenance.
- You could show videos of how a pretreatment bath is maintained in a powder coating line.
- You could divide the class in small groups of 3-5 to demonstrate different kinds of problems in pretreatment bath and how to avoid them by regular maintenance.

### Demonstrate

- Different kinds of problems in pretreatment bath and how to avoid them by regular maintenance.
- How to check concentration, temperature, pH, conductivity, oil content and cleanliness.
- How to remove surface oils from tank using oil skimmers.
- Remove particles from the bottom of the tank using bag filtration.
- Remove emulsified and suspended oils using ultrafiltration or centrifugation.

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 5.1.3 Booth Maintenance

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- There are some common maintenance tasks that can extend the lifespan of the powder coating equipment and prevent costly downtime. Performing these scheduled routine tasks will not only help prolong the life of the equipment, but will also help achieve the highest quality finishes for the product.
- Once a month – check the fan belts for wear and tension. Do not overtighten the belts. Make sure the belts have the recommended amount of slack.
- Once every 1-3 weeks I) change or clean the blanket filter – check and change the blanket media filter on the spray booth. Vacuum off the blanket filter to increase the filter's lifespan but do not spray it with compressed air. Compressed air will tear the filter and reduce performance. II) Rotate the bag filters – rotating the filter will even out wear on the bag filters and make them last longer. Vacuum off but do not use compressed air.
- It is recommended to replace the bag filters once every 3 months to prevent powder build-up.
- Once every 9-18 months – check the HEPA filters and make sure they are still in good condition and working properly.

### Explain

- The importance and actions for daily/weekly checks.
- The importance and actions for monthly checks.
- The importance and actions for annual checks.

### Notes for Facilitation

- Give the students a description of different parts of the powder booth which require cleaning and maintenance.
- You could show videos of how the powder coating booth is maintained on a daily, weekly, monthly and annual basis in a powder coating line.
- You could divide the class in small groups of 3-5 to demonstrate how to clean and maintain a powder coating booth.

## Demonstrate



- The actions required to clean and maintain the powder booth.
- Remove deposits from paint booth.

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

### 5.1.4 Cleaning while colour change

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- The colour change process varies depending on the type of colour change being performed. The time it takes to perform a colour change will depend on the number of spray guns in the system.
- There are two basic types of colour changes. Similar shade (when changing from either a light colour to another light colour, or a dark colour to another dark colour) and different shade (when changing from either a light colour to a dark colour, or a dark colour to a light colour).
- Conditions for an Effective Colour Change - For the colour change process to be effective, the following conditions must be met: Keep spare sieve screens, reclaim receiver filters, and powder supply containers on hand to allow quick replacement during colour change and thorough cleaning while the system is coating parts. Operate the system in spray-to-reclaim mode during normal operation. Keep the area on and around the booth base clean to avoid cross-contamination of powder. Condition the booth interior at least once each week.

#### Explain

- The importance and actions for daily/weekly checks.
- The importance and actions for monthly checks.
- The importance and actions for annual checks.

#### Notes for Facilitation

- Give the students a description of the cleaning process required before colour change.
- You could show videos of the cleaning process before colour change.
- You could divide the class in small groups of 3-5 to demonstrate how to clean the powder coating booth before colour change.

#### Demonstrate

- The actions required to clean and maintain the powder booth for colour change.

#### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 5.1.5 Bake Oven Inspection and Cleaning

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- There are some common maintenance tasks that can extend the lifespan of the powder coating curing oven and prevent costly downtime. Performing these scheduled routine tasks will not only help prolong the life of the equipment, but will also help achieve the highest quality finishes for the product.
- Once a month clean the photo eye - gently clean the photo eye of grime and debris with a clean cloth. The photo eye is located near the center of the burner assembly on the heat unit. Follow the gas train and piping until you come to the hole in the skin of the heat unit. The photo eye is a purple and white cylinder on a flexible conduit aimed directly into the hole and pointed at the burner flame. Over time, the lens of the photo eye may become dirty and no longer detect the flame. This will automatically shut off the burner. Regular cleaning of the photo eye will help avoid this issue. II) Check the fan belts - Check the fan belts for wear and tension. When checking tension, the belt should have between a half-inch to an inch of slack when you press down firmly on the belt. DO NOT over-tighten the belts. Make sure the belts have the recommended amount of slack. III) Grease bearings - Using a high-temperature grease (rated over 400 degrees), apply one or two small squirts once a month to the grease fitting above the bearings. Be careful not to apply too much grease on the bearings - one or two small pumps from a grease gun per month should be enough. One bearing is easy to see, the other is behind the safety guard below the motor.
- Check door gasket once a year. Replace it if it shows significant wear or is torn. II) check/ adjust door hinges annually. This will help prevent door alignment issues due to hinge wear or looseness.

### Explain

- The importance and actions for daily/weekly checks.
- The importance and actions for monthly checks.
- The importance and actions for annual checks.

### Notes for Facilitation

- Give the students a description of the bake oven cleaning and inspection required on weekly, monthly and annual basis.
- You could show videos of the bake oven cleaning and inspection process.
- You could divide the class in small groups of 3-5 to demonstrate how to clean and inspect the bake oven.

## Demonstrate



- The actions required to clean and maintain the bake oven.

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

## Unit 5.2: Maintain Powder Coating Tools and Equipment

### Unit Objectives



At the end of this unit, you will be able to:

1. Describe how to maintain the cleaning devices.
2. Describe the cleaning process for powder hoses and guns.
3. Describe the cleaning process for jigs, hooks and racks.
4. Describe the process for cleaning the facility.



## 5.2.1 Maintain the Cleaning Devices

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- It is important to have the right cleaning devices and their regular upkeep and maintenance.

### Explain

- The importance and actions for daily/weekly checks.
- The importance and actions for monthly checks.
- The importance and actions for annual checks.

### Notes for Facilitation

- Give the students a description of the cleaning devices and the cleaning and inspection required for them on weekly, monthly and annual basis.
- You could show videos of the powder coating cleaning devices and their upkeep and maintenance.
- You could divide the class in small groups of 3-5 to demonstrate how to clean and store the powder coating cleaning devices.

### Demonstrate

- The actions required to clean and maintain the powder coating tools and equipment.

### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 5.2.2 Cleaning of Powder Hoses and Guns

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- The cleaning and maintenance of powder coating guns and equipment on a regular basis is required for high quality coating.

### Explain

- The importance and actions for daily/weekly checks.
- The importance and actions for monthly checks.
- The importance and actions for annual checks.

### Notes for Facilitation

- Give the students a description of the tools and equipment cleaning and inspection required on weekly, monthly and annual basis.
- You could show videos of the powder coating tools and equipment cleaning and inspection process.
- You could divide the class in small groups of 3-5 to demonstrate how to clean and inspect the powder coating tools and equipment.

### Demonstrate

- The actions required to clean and maintain the powder coating tools and equipment.

### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

### 5.2.3 Cleaning Process for Jigs and Racks

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- Every time a rack passes through a powder coating system the rack is powder coated along with the items being finished. The coating applied repeatedly to the rack quickly becomes a problem, since it insulates the rack more and more with each pass, progressively decreasing part-to-rack conductivity.
- After a day of use, hangers may collect 1-2 mils of coating material, and after only one pass transfer efficiency can drop by 50-60%. Thus, conductivity has been degraded and transfer efficiency is even lower than indicated by these guidelines. More and more powder must be recirculated.
- Most powder finishers deal with this problem in one way or another, some by crudely grinding down contact points to restore conductivity. But eventually, all finishers must strip away the coating buildup from the racks and fixtures. For good efficiency and minimising waste, racks should be stripped at the end of each day.
- Some finishers prefer not to deal with rack stripping. They out-source the cleaning job. Stripping becomes a specialist's problem and the finisher does not have to spend time stripping.
- When it comes to in-house solutions for stripping racks and fixtures, several solutions are available. Among them, chemical stripping, mechanical stripping and pyrolytic stripping. The pyrolytic stripping may include the use of heat-cleaning ovens, open flames, hot fluidised beds, molten salt baths and lasers. Burn-off ovens—also called heat cleaning ovens—are a popular tool for stripping powder coated racks and parts.
- Although burn-off ovens are an excellent tool for removing organic coatings from racks and hangers, finishers should lend thoughtful consideration to factors such as substrate, rack size, coating type, return on investment, operating costs, environmental impact and employee safety before committing to a particular stripping technology or deciding whether to perform the stripping process in-house or outsourcing it.

#### Explain

- The importance and actions for daily/weekly checks.
- The importance and actions for monthly checks.
- The importance and actions for annual checks.

## Notes for Facilitation



- Give the students a description of the cleaning and inspection required for jigs and racks on weekly, monthly and annual basis.
- You could show videos of the jigs and rack cleaning and inspection process.
- You could divide the class in small groups of 3-5 to demonstrate how to clean and inspect jigs and racks

## Demonstrate



- The actions required to clean and maintain the jigs and racks.

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 5.2.4 Cleaning the Facility

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- Cleaning the facility daily is extremely important for a powder coating line.
- Vacuum the floor, walls and ceiling daily.
- Check the air pipelines and valves for any choking regularly.
- Clean the facility before powder application.

### Explain

- The importance of cleaning the facility regularly.
- The actions required to clean the facility.

### Notes for Facilitation

- Give the students a description of the facility cleaning of a powder coating line required on weekly, monthly and annual basis.
- You could show videos of the facility cleaning in a powder coating line.

### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.





## Key Learning outcomes

At the end of this module, you will be able to:

1. Describe the meaning and importance of targets, performance indicators, and quality orientation.
2. Learn behavioral skills to interact with your colleagues and co-workers effectively.
3. Describe steps to achieve customer satisfaction.



## Unit 6.1: Understand Product/Service Quality Requirements

### Unit Objectives



At the end of this unit, you will be able to:

1. Describe concepts like performance targets, performance indicators, target customer and quality and service orientation.
2. List and describe steps to understand the customer requirements.

## 6.1.1 Performance Target

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- Setting a target is not about guessing what one can achieve. It involves knowing where an employee is now and what the person needs to achieve, and determining challenging but realistic amounts of improvement needed to get there.
- Target can be defined as the desired level of performance one wants to achieve as measured by indicators.
- For achieving a target there must be a specific and clear cut plan, there must be a way to determine and measure whether you have could achieve your target or not, the target must be realistic and achievable and it must have a timeframe within which it must be achieved.
- Define where you are now.
- Define what you want to achieve and by when.
- Be clear and informed about what you need to achieve your target on time or if there is anything which may be a hindrance for accomplishing your target.

### Explain

- The meaning and importance of performance target.
- SMART way to achieve target.
- receive job order and instructions from reporting superior.
- Understand the work output requirements, targets, performance indicators and incentives.
- Deliver quality work on time and report any anticipated reasons for delays.
- Escalate unresolved problems or complaints to the relevant senior /supervisor.
- Communicate maintenance and repair schedule proactively to the supervisor/relevant senior.
- Receive feedback on work standards.
- Document the completed work schedule and handover to the supervisor.

## Notes for Facilitation

- Find out from the students what do they understand by performance target.
- Give the overview of the different kind of tasks one may be engaged for a powder coating unit.
- Give examples to explain performance target at workplace.

## Ask

- Have you ever chased a target? What was your experience?
- Do you know anyone who always had a target during your school/college days?
- Can you imagine what are feelings when someone achieves his/her performance target consistently?
- Why do you think there are performance targets at workplace?
- Could you think of various reasons as to what drives a performance target?
- What could be likely benefits of achieving performance target consistently?
- What could be negative side of missing out on achieving the performance target?

## Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 6.1.2 Performance Indicator

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- A **Key Performance Indicator** is a measurable value that demonstrates how effectively an objective has been achieved.
- Performance is measured based on the key performance indicator (KPI) for the job/role.
- Achieving KPI on a consistent basis may result in increased pay and promotions.
- One way to evaluate the relevance of a KPI is to use the SMART criteria. The letters are typically taken to stand for **s**pecific, **m**easurable, **a**ttainable, **r**elevant, and **t**ime-bound.
- Is your performance indicator specific?
- Do you have a way of measuring your performance e.g. 0 defect, 10/10 rating on customer satisfaction etc.
- Is your goal or task realistically attainable?
- How relevant is the goal to the overall company goal?
- What is the timeframe for achieving this goal?

### Explain

- The meaning and importance of performance indicators.
- Receive feedback on work standards.
- Document the completed work schedule and handover to the supervisor.

### Notes for Facilitation

- Find out from the students what do they understand by key performance indicators.
- Give examples to explain key performance indicators.
- Give the overview of the production process for powder coating and explain KPI for a powder coater.

## Ask



- Can you tell how did you know you passed or failed in your school exams?
- Did your teacher inform you beforehand the pass/fail criteria?
- What happens when someone fails in the exam?
- What happens if someone passes in all the subjects?
- What will happen if you fail to achieve your KPI in your workplace?
- What will happen if you achieve your KPI consistently?

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

### 6.1.3 Target Customer

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- Your target customer is the person you've identified as most likely to purchase your products.
- If you will be working in a factory setting as a powder coater, then your target customers are the clients of the company who give business.
- If you choose to become an entrepreneur as a job coater, then your target customer would be those who are most likely in need of your services. You need to do a market and an environmental scan to understand your target market and target customer.
- As a powder coater, you must understand the needs and requirements of your customer and how you can satisfy your customer.
- As an entrepreneur, your marketing plan should cover both targets -- the market and customer. The broader your reach in your marketing efforts, the more likely that you'll draw enough potential customers to take advantage of your services. Moreover, the more diverse your marketing efforts, the more you can raise your level of visibility as a business. Increased visibility means you may reach those outside of that market as well.

#### Notes for Facilitation

- Find out from the students what they understand from target customer.
- Give examples to explain how to understand and serve the target customer best.
- Give the overview of how a job coater can find the target customer.

#### Ask

- What will happen if you fail to market your business without knowing your target customer?
- What will happen if you know your target customer?

## Role Play



- You can make the students role play in pairs.
- Each person in the pair to play a job coater and a customer in turn.
- Give them different scenarios to role play between a customer and a job coater.
- Summarise the learning from the role play.
- Encourage students by appreciating their participation.

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 6.1.4 Quality & Service Orientation

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- Quality orientation means attention to detail and accomplishing tasks by considering all areas involved, no matter how small; showing concern for all aspects of the job; accurately checking processes and tasks; being watchful over a period.
- A quality oriented person will show concern for all aspects of the job; check processes and tasks for accuracy; seek out opportunities for improving processes, outcomes or products.
- Service orientation is the ability and desire to anticipate, recognise and meet others' needs, sometimes even before those needs are articulated. Service oriented people focus on providing satisfaction and making themselves available to others.
- Develop service orientation by thinking about the company's current customers. These could be the company's direct customers, partners, or 'internal' customers, such as other groups within the company.
- Focus on improving the level of service provided. Identify customers' pain points (have they had a complaint in the past?), their needs and concerns. Find out what makes them successful and find ways to help them achieve that. Set clear and measurable set of goals, and benchmark against it on a regular basis.
- Revisit the goals periodically and modify it based on feedback or customers' changed needs and evolve.

### Notes for Facilitation

- Find out from the students what they understand from quality orientation and service orientation.
- Give an overview of the quality orientation required for different tasks for the production process of powder coating.
- Give an overview of the service orientation required to serve the customers as a powder coater.
- Give examples to explain quality orientation and service orientation.



## Ask



- Can you tell about a time you found quality defects in something you purchased? What was wrong? How did you notice it?
- Sometimes it's impossible to check all the details of a project. Tell us about a time that you simply had too much to do and let errors slip through. What happened and how did you fix it?
- Describe a situation in which you overlooked a critical detail. What caused this to happen? What was the result?
- Tell us about a time the details of something you were doing were especially important. How did you attend to them? What was the outcome?
- Do you know anyone who per you has high quality orientation?
- Do you know anyone who per you has high service orientation?

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

## Unit 6.2: Communicate with Colleagues Effectively

### Unit Objectives



At the end of this unit, you will be able to:

1. Explain the importance of building trust with colleagues and co-workers.
2. Describe the rules of communication when interacting with colleagues and co-workers.
3. List right and wrong behavior with a colleague and co-worker.

## 6.2.1 Building trust with colleagues and co-workers

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- At the workplace, it is important to establish yourself as a professional and credible person.
- Success at workplace depends on your conduct and whether you are perceived favourably by your superiors and colleagues.
- At workplace people observe you all the time and make an assessment if you are someone who can be given responsibilities. It is also advisable that you build a healthy relationship with everyone at workplace to get maximum cooperation.

### Explain

- The meaning and importance of building trust with colleagues and coworkers.
- Exhibit trust, support and respect to all the colleagues in the workplace.
- Aim to achieve smooth workflow.
- Help and assist colleagues with information and knowledge.
- Seek assistance from the colleagues when required.
- Identify the potential and existing conflicts with colleagues and resolve.
- Pass on essential information to other colleagues on timely basis.

### Notes for Facilitation

- Find out from the students what do they understand by building trust with people at workplace.
- Emphasise the role of attitude in building trust with each other in personal life and in the workplace.
- List the everyday actions which can help build trusting relationship with superiors and colleagues.
- Give examples to explain how one can build trust with others.

### Ask

- What are the ways you build trust with your family and friends?
- What actions can you take to build trust with your superiors, colleagues and customers?
- What do you think is the role of your attitude in building trust with others?

## Role Play



- You can make the students role play in pairs.
- Give them different scenarios to role play – different scenarios between two colleagues, a meeting scenario, supervisor and the powder coater.
- Summarise the learning from the role play.
- Encourage students by appreciating their participation.

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 6.2.2 Communication Rules when interacting with colleagues and co-workers

### Resources to be Used



- White board, marker, pen, notebook.

### Say



- At the workplace, it is important to be able to communicate effectively with peers as it helps to get your jobs done by answering questions, sharing information, and offering feedback. Not to mention that effective communication can bring fun and energy to the workplace.
- The first step of effective communication is to understand yourself and your communication style.
- Reflect on how others react to your communication.
- Use the right medium to send a message for it to be well received.
- Recognise co-workers for a job well done and the help provided.
- If you take a moment to put yourself in your co-worker's shoes, it can positively impact your communications with them. Whether they're happy or stressed, you can either share in their enthusiasm or not contribute to their frustration.
- Yes, there will be times when, no matter how hard you try, the communication will not go as planned. Instead of ignoring the situation and letting it get worse, have a conversation with your co-worker. Let them know that you value the relationship, and you'd like to talk it out.

### Explain



- The meaning and importance of following effective communication rules with colleagues and coworkers.
- Maintain the etiquette, use polite language, demonstrate responsible and disciplined behaviors to the colleagues.
- Interact with colleagues from different functions clearly and effectively on all aspects to carry out the work among the team and understand the nature of their work.
- Put team over individual goals and multi task or share work where necessary supporting the colleagues.
- Work with cooperation, coordination, communication and collaboration, with shared goals and supporting each other's performance

## Notes for Facilitation



- Find out from the students what do they understand by communicating effectively with people at workplace.
- Emphasise the role of attitude in communicating with each other in personal life and in the workplace.
- List the everyday communication rules which can help build trust in relationships with superiors and colleagues.

## Ask



- What are the ways you prefer to communicate with your family and friends?
- What communication rules you can follow to build healthy relationships with superiors, colleagues and customers?
- What do you think is the role of your attitude while communicating with others?
- Think about the last five conversations you had that didn't go well, and ask yourself the reason.
- Think about the last five communications you had that went well and the reason. Identify the common elements or trends.

## Role Play



- You can make the students role play in pairs.
- Give them different scenarios to role play – different scenarios between two colleagues, a meeting scenario, supervisor and the powder coater.
- Summarise the learning from the role play.
- Encourage students by appreciating their participation.

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 6.2.3 Right and wrong behavior

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- At the workplace, follow the rules of right conduct. The right and wrong behavior at workplace may be governed by the type of organisation, the culture of the place, the level of interaction required between people at the workplace, the industrial and legal regulations of the land etc.

### Notes for Facilitation

- Find out from the students what do they understand by right and wrong behaviour at workplace.
- List the everyday actions and behaviour which are right and wrong with superiors and colleagues at workplace.
- Give examples to explain right and wrong behaviour at workplace.

### Ask

- Can you tell if your family and friends ever insist on you behaving right and avoid wrongful behaviour?
- Think about the last five times you were told your behaviour was wrong, and ask yourself the reason.
- Think about the last five times you were appreciated for your behaviour and the reason. Identify the common elements or trends.

### Role Play

- You can make the students role play in pairs.
- Give them different scenarios to role play – different scenarios between two colleagues, a meeting scenario, supervisor and the powder coater.
- Summarise the learning from the role play.
- Encourage students by appreciating their participation.

### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

## Unit 6.3: Achieve Customer Satisfaction

### Unit Objectives



At the end of this unit, you will be able to:

1. Explain the importance of customer satisfaction.
2. Describe the steps to achieve customer satisfaction.



### 6.3.1 What do we understand by customer satisfaction?

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- A faster response to the customer makes it easier to solve a problem. Failure to return a call or email is inexcusable. Customers are delighted by high responsiveness. If there is no immediate answer, quickly inform the customer that their inquiry has been received and will revert soon. Then do it!
- When responding to a customer complaint always begin by assuring the customer that the problem will be fixed. This immediately removes the adversarial relationship that can lead to messy and expensive confrontations.
- The object of problem resolution is not to “satisfy” the customer but to “amaze” them by going above and beyond their expectations. which will transform an angry customer into a loyal customer.

#### Notes for Facilitation

- Find out from the students what they understand by customer satisfaction.
- Emphasise the role of a powder coater in achieving customer satisfaction.
- List the everyday actions of the powder coater which can help achieve customer satisfaction.
- Give examples to explain the concept.

#### Ask

- What are the ways you can achieve customer satisfaction?

#### Role Play

- You can make the students role play in pairs.
- Give them different scenarios to role play for each step – building rapport with the customer, exploring customer needs, demonstrating sample products, closing by agreeing on terms and conditions, actively asking for feedback after the product delivery.
- Summarise the learning from the role play.
- Encourage students by appreciating their participation.

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 6.3.2 Steps to achieve customer satisfaction

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- Follow the steps to achieve customer satisfaction religiously and it will result into very high customer satisfaction.

### Explain

- Build effective relationship with the customer. Maintain a positive, sensible and cooperative manner all time. Maintain proper body language, dress code, gestures and etiquettes towards the customers.
- Communicate with the customers in a polite, professional and friendly manner.
- Listen actively and have a two-way communication.
- Ask more questions to the customers and identify their needs.
- Possess strong knowledge on the product, services and market.
- Brief the customers clearly on potential costs and hazards.
- Understand the customer expectations correctly and provide the appropriate products and services.
- Understand the customer dissatisfaction and address or escalate their complaints effectively.
- Avoid interrupting the customers while they talk.
- Inform the customers on any issues or problems before hand and on the developments involving them
- Ensure to respond back to the customer immediately for their voice messages, e-mails, apps, etc.
- Develop good rapport with the customers and promote other products and services.
- Seek feedback from the customers on their understanding to what was discussed. Explain the terms and conditions clearly.

### Notes for Facilitation

- Emphasise the role of following the steps for achieving customer satisfaction.
- List the everyday actions of a powder coater which can help achieve customer satisfaction.
- Give examples to explain the concept.

## Ask



- What are the ways you can build friendly relations with customers?
- What are the ways you can find out customers' requirements?
- What are the ways you can demonstrate products to your customers?
- What are the ways you can agree on design and plan of work with the customer?
- What are the ways you can ask for customer feedback?

## Role Play



- You can make the students role play in pairs.
- Give them different scenarios to role play for each step – building rapport with the customer, exploring customer needs, demonstrating sample products, closing by agreeing on terms and conditions, actively asking for feedback after the product delivery.
- Summarise the learning from the role play.
- Encourage students by appreciating their participation.

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

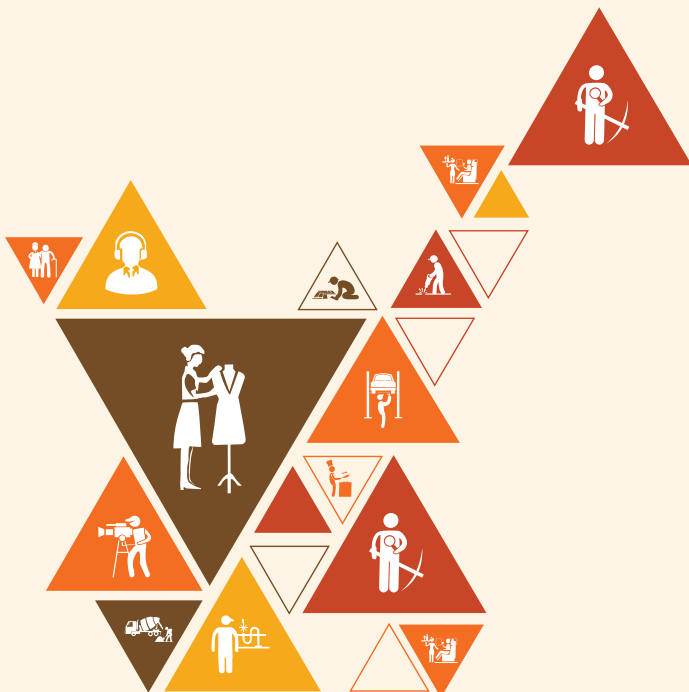
**PAINTS AND  
COATINGS  
SKILL COUNCIL**



# 7. Maintain Standards of Product/Service Quality

Unit 7.1 – Understand product/service quality requirements

Unit 7.2 – Achieve quality standards



## Key Learning outcomes

At the end of this module, you will be able to:

1. Explain the product/service quality requirements for powder coating process.
2. Follow company's policy and work instructions on quality standards to achieve customer satisfaction.
3. List out various defects and tests to check the quality of the powder coating film.

## Unit 7.1: Understand Product/Service Quality Requirements

### Unit Objectives



At the end of this unit, you will be able to:

1. Describe the target customer and the quality standards defined by the company.
2. Implement the improvement suggested by supervisor and the customer.

## 7.1.1 Target Customer

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- You can recall that we have already learnt about target customer and how to deal with a customer for maximum customer satisfaction.
- Keep in mind the customer requirements and specifications while carrying out powder coating application.
- Follow specifications of the OEM (Original Equipment Manufacturer), if working in an in-house plant of the OEM.
- Follow customer specification, if for a job coater.

### Explain

- Profiles of expected customers.
- Understand the target customers and their product/ service quality requirements as defined by the company.
- Receive superior's / customer feedback regularly.

### Notes for Facilitation

- Give the overview of different kind of customers for powder coating job and their unique requirements.
- Give real-life examples of customer specifications to be followed for powder coating job.
- You could show videos of powder coating application for an in- house plant of an OEM, OEM vendors following customer specifications and a job coater dealing with the customers.

### Ask

- What are the ways you can understand the customer requirements?
- As a powder coater, how would you ensure that the customer specifications and quality standards are fulfilled?
- If you are an entrepreneur what would you do if a customer gives you a free hand for job coating?



## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 7.1.2 Meeting and Exceeding customer expectations

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- While dealing with customers it is important to not only meet the customer expectations but also to exceed their expectations and delight them.
- Today customers have a wide variety of choice and they will choose to go to a vendor who not only fulfills their requirements but also goes an extra mile to be make them happy.
- It is a good practice to get feedback from the customer about the quality of the finished products.
- Find out if the customer is satisfied with the product. If not, seek suggestions from the customer for improvement.
- Note down customer's suggestions and recommendations to be incorporated for further applications.

### Explain

- Understanding customer requirements.
- Understanding the total powder coating system, its facility and the limitations.
- Fool proofing the process with right equipment, tools and materials.
- Getting feedback from the customer and incorporating suggestions for improvement.
- Aim to build a good connect with the customers through quality product / service.
- Keep tab on frequent discussions with regular customers on general likes and dislikes and customer expectations.
- Receive updates on regular feedbacks from the clients on current service, complaints, and improvements to be made, etc.
- If necessary, compulsively seek customer rating of product / service to help develop a set of regularly improved procedures.
- Demonstrate quality orientation at all level.
- Aim to gain long-lasting loyalty of customers through satisfaction.
- Weigh the cost of fulfilling unscheduled customer requests, consult with senior and advise the customer on alternatives.

## Notes for Facilitation

- Find out from the students what do they understand from meeting and exceeding customer expectations.
- Give the overview of the feedback process from the customer and how it can be incorporated for the next application work.
- List the do's and don'ts for meeting and exceeding customer expectations.
- Give examples to explain the concept

## Ask

- Have you ever had a shopping experience as a customer when you felt that not only your needs were met but you felt happy and delighted? how did you feel? Can you reflect what made you happy and delighted?
- As a powder coater, what actions could be taken to delight the customers?

## Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

### 7.1.3 Quality standards of the company

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- It is important to ensure the powder coating application meets the required professional and quality standards of the company.
- The powder must be sourced from one of the approved powder manufacturers and coated to the required standards.
- The powder coating unit must evaluate business practices, process elements, equipment, capabilities, employee competencies and quality control capabilities of a coater to ensure they can produce a high-quality powder coated product with a high degree of customer satisfaction.

#### Explain

- Visual checks of the finished coating.
- Mechanical strength check.
- Corrosion resistance checks of the film.
- Outdoor durability test.

#### Notes for Facilitation

- Find out from the students what do they understand from the quality standards of the company.
- Give the overview of the quality standards maintained in the production process for powder coating.
- List different tests and checks carried out on the coated film to meet the quality standard of the company.

#### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

## Unit 7.2: Achieve Quality Standards

### Unit Objectives



At the end of this unit, you will be able to:

1. Explain the process of maintaining and enhancing quality standards.
2. Describe various tests and their pass/fail criteria and acceptable tolerance level.
3. List the equipment used for quality tests.
4. Ways to improve company's customer satisfaction rating.

## 7.2.1 Maintain and Enhance Quality Standards

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- A company's policy defines and ensure adherence to quality standards.
- A company formulates SOP based on the customer specifications to maintain a consistent e quality.

### Notes for Facilitation

- Find out from the students the role of a powder coater in maintaining and enhancing quality standards of the company.
- Give the overview of how a powder coating unit maintains and enhance the quality standards.
- List the equipment, machine and tools used for checking the quality standards of the powder coated film.
- Give examples to explain the concept.

### Ask

- What do you think could be your role as a powder coater to maintain the quality standards?
- What do you think you can do to enhance the quality standards?

### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 7.2.2 Tests and standards to check quality

### Resources to be Used

- White board, marker, pen, notebook.
- DFT gauge 0 – 1000 microns.
- Adhesion tester X cut type as per ASTM D 3359.

### Say

- There are various tests to check the quality of the powder coated parts.
- First I will explain how various tests are carried out and then will demonstrate in the lab how each test is conducted.

### Explain

- Inspection criteria for the finished coated part.
- Dry film thickness measurement.
- Gloss check.
- Colour check.
- Pencil hardness test.
- Flexibility test.
- Adhesion test.
- Impact test.

### Demonstrate

- Inspection of the coated part.
- Dry film thickness measurement.
- Gloss check.
- Colour check.
- Pencil hardness test.
- Flexibility test.
- Adhesion test.
- Impact test.

## Notes for Facilitation

- Give the overview of the various tests and inspection criteria carried out for the powder coated job.
- List the equipment, machine and tools required for each test.
- Give examples to explain the importance and procedure for each test.
- You could show videos detailing the process for each test and inspection for the powder coated part.

## Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.



## 7.2.3 Defects in the powder coated film

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- Various defects may be observed on a powder coated film.
- First I will explain you the defects and its likely cause and then how to troubleshoot the problem.

### Explain

- Excessive orange peel.
- Gloss too low or too high.
- Inconsistent film thickness.
- Poor impact resistance and/or flexibility.
- Pinholes.
- Poor adhesion.
- Cissing or craters.

### Notes for Facilitation

- Give the overview of the various defects in a powder coating film.
- List the equipment, machine and tools required for troubleshooting.
- You could show videos for various defects which appear on powder coated film.

### Elaborate

- Defects on the powder coating can appear for various reasons. As a powder coater, you must know the possible defects and the cause for it. The following questions and answers can help you to understand some of the major issues during the application and can help you to become more skillful in the application process.

#### **Why doesn't the gun control show any Kv reading?**

Possible Causes:

- Loss of power to the unit.
- Failure of LED driver (circuit board).

## Elaborate



- Internal gun failure (cascade).

### Why does powder surge from the gun?

Possible Causes:

- Not enough supplemental or forward air to keep the powder in suspension while moving through the powder hose.
- Improper seal between the powder injector and the lift tube in the gun feed hopper.
- Possible blockage in the powder path from build up or impact fusion. Check the gun tube, powder hose, and pump insert.

### Why does the powder drift out of the openings of the spray booth?

Possible Causes:

- Not enough containment air flowing through the booth and recovery system.
- Cartridge filters not receiving adequate cleaning. Increase pulse down air pressure or volume.
- Cartridge filters nearing the end of their expected life.
- Final filters becoming clogged. Note that final filter clogging may be related to poor upstream seals or leakage of powder in the recovery.

### Why do I need to add virgin powder to my reclaim?

As virgin powder is applied, the larger particles more readily adhere to the part. This leaves the over sprayed powder with a lower average particle size. As this occurs during each cycle through the system, the recovered material may become laden with fine particles. Eventually, the reclaimed material will be nearly unmanageable in both fluidisation and application.

### What is impact fusion?

Friction may cause powder particles to fuse along the walls of the powder hose and other components in the powder delivery path. Impact fusion is the combining of these powder particles to form a solid mass during the delivery and application process.

### What does proper fluidisation look like?

The fluidised material should take on fluid-like characteristics. It should have an appearance like that of water simmering on low heat. The material should not be boiling hard.

### What is electrode-rinsing air?

Electrode-rinsing air is a feature that provides circumferential air that keeps the electrode free of powder build-up to ensure consistent maximum charging efficiency of the gun.

### Why won't the powder adhere to the part?

Possible Causes:

- Gun or control failure resulting in a loss of Kv at the gun.
- Inadequately grounded parts due to dirty hangers or poor conveyor grounding.
- Electrical contact failure to the electrode or excessive powder build up resulting in a loss of charge potential.

## Elaborate

### **What is the difference between Style and Zone gun triggering?**

Zone triggering typically relates to the guns automatically spraying when a photo eye or a light curtain is used to determine the vertical zone is broken or that a part is present in that particular zone (the part opening may be broken into multiple zones).

Style triggering generally uses multiple means of sensing in order to identify the part type or style. The guns then trigger on or off based on a recipe or pre-set parameters pre-programmed by the user.

The fundamental difference between zone and style is that zone formats do not care what the part is, since they paint by size. Style must recognise each part or family in order to know how to paint.

### **What is an acceptable ground for maximum transfer efficiency?**

Uncoated metal parts, clean hangers, and clean conveyors have very little resistance to ground and are excellent electrical conductors. What can degrade this ideal path to ground is powder build-up on the contact points of the hangers or conveyor. Also, the conveyor may have swivels or indexing assemblies that, when contaminated, can impede grounding. All of these in total must not exceed one Mega Ohm resistance to ground.

### **How do I get good powder coverage into Faraday areas?**

Faraday cage effect defines a condition that occurs when parts are coated that have recesses, inside corners, channels, or protrusions on their surfaces. The Faraday cage is the area of the part where the external electrical field does not penetrate. Powder coating of recessed areas is often complicated. For the successful coating of Faraday areas, the following conditions must be met: powder must be well charged, airflow must be sufficient to deliver the powder inside a recess but not excessive to preclude powder deposition, and the external electric field must be controlled to reduce the "push" for powder particles to deposit on the edges of a Faraday cage. Because most Faraday areas involve some type of "pocket" areas, it is important that the method for directing the powder flow in allows for displacement of the air in the pocket area to allow penetration.

### **How do you know if powder is cured?**

There are two conditions that must be met to achieve proper cure of a powder coating. The first is temperature, referred to as metal temperature, and the second is time. The time/temperature requirements of a powder material must be achieved to obtain a full cure. A cured thermoset powder coating will not re-melt upon further heating. To ensure proper time and temperature it is often best to test using a travelling thermometer (Datapaq or similar device) to provide a metal temperature and time data.

### **Does particle size make a difference in powder coating?**

Particle size plays an important role in the application process. Size distribution affects many other properties critical to consistent performance including: fluidisation, powder transport in hoses, uniform cloud density, powder movement in air, electrostatic charging, deposition and build rate, transfer efficiency, Faraday cage penetration, wraparound, and film smoothness. Size distribution produced by the powder manufacturer must take the coating system design and anticipated changes into account to provide a suitable product. Final cured surface appearance may also be affected by the particle size distribution and flow rate.

### **Are there powders for interior or exterior use?**

One of the most important considerations in defining the end use performance is weatherability. Outdoor exposure results in absorption of ultraviolet energy. This energy can attack the organic binder and result

## Elaborate



in gloss loss and colour change. Due to a tendency to chalk, epoxies and epoxy containing hybrids are generally not recommended for outdoor use when aesthetics is a primary concern. Polyesters and acrylics on the other hand provide excellent UV light stability and typically find use in architectural, automotive, lawn and garden as well as outdoor furniture markets.

### **How do I check for proper adhesion, and inter-coat adhesion?**

Adhesion is dependent on the surface preparation of the substrate, the appropriate selection and maintenance of pre-treatment, and the proper melt and cure of the powder coating. Adhesion may be tested by several different methods. A commonly used technique is the cross-hatch test. In this method, crossed cuts are made through the coating. Adhesive tape is then applied to the cut coating and then removed quickly. The coating adhesion is then measured by its ability to remain on the substrate and to not be removed by the tape.

Powder coatings vary in their ability to provide inter-coat adhesion when recoated. Epoxy powders tend to be harder and more prone to inter-coat adhesion problems, particularly if they have been over baked. On the other hand, polyesters and epoxy-polyester hybrids usually recoat well. Chemistry for recoat is also important and should be tested with your powder supplier.

### **How do I select the proper coating for my application?**

The selection of a coating should be undertaken as a cooperative effort between the end user and the powder formulator (supplier). In developing a coating for a particular application, the formulator must consider a number of factors. As an example, if the coating requires high pencil hardness and mar resistance along with weatherability, then flexibility may be reduced. If superior chemical resistance is required, then weatherability and over bake yellowing resistance can be compromised. Other considerations may be cure time and temperature, substrate type and treatment, and application method. Only when all requirements of a particular application are considered can a formulator recommend the proper coating type.

### **What is the difference between oven cycle time and dwell time?**

The oven cycle time is comprised of the bring-up time plus the dwell time for a proper powder cure. The bring-up time is the time required to attain the desired substrate cure temperature of the part. The dwell time is the time required to hold the substrate at cure temperature. These times and temperatures are available from the cure schedule for the powder coating. In some applications, shorter oven cycle times are possible by rapid heating of the substrate to a higher cure temperature for a shorter dwell time.

### **How clean should my compressed air be?**

Next to proper grounding, clean compressed air is the most important thing. Oil and water do not mix with powder. In a powder system, air plays a big role. Powder is fluidised with air, pumped to the guns with air, and the cartridge filters are back-pulsed with air. The equipment and powder manufacturer should be consulted regarding the air quality for optimal performance. In general, a minimum 35°F dew point and less than 0.1 ppm contaminate or oil is a good starting point.

### **How should I filter my compressed air?**

Always consult your compressor manufacturer. You should have good oil and water extractors along with a refrigerant or a desiccant dryer system. With either system type selection, an oil coalescing filter with automatic drain and particulate filter are recommended.

## Elaborate

### **How should I maintain my compressed air filters and air dryer?**

Drain extractors daily and check internal filters monthly. Replace desiccant beads when indicated and have your refrigerant dryers serviced once a year. Depending on size and volume, an automatic indicator may be used to ensure proper performance. Again, always consult the manufacturer's manual.

### **How close should I install my air dryer to the powder booth?**

Place the dryer as close to the room as possible, but not in the powder room. This will give the compressed air less of a chance to form moisture in the pipe as it travels to the booth.

### **Can my environmental room be too cold? Yes.**

If the room is too cold, condensation can form on supply ducts and vents, then drip on parts or the powder booth.

### **What is vortex air?**

This is air that is supplied at the nozzle to twist the pattern and close the donut hole pattern that is common with diffuser or round-type nozzles. This can provide better direct powder penetration into corners. Additional air will increase the pattern size, potentially reducing the need to change tips.

### **How often should I clean my gun? Pump?**

Guns should be cleaned after each colour change. At the end of the day, you should purge the gun, pump, and hose to prevent moisture from settling in the powder and clogging things up for the next use. Depending on the volume of powder sprayed and time between colour changes, deep cleaning and worn part replacement should be reviewed weekly.

### **How often should I change my powder hose?**

It is recommended that you change your powder hose at least once a year depending on wear caused by the powder or if you are having contamination problems. Frequently inspect for cracking or impact fusion that may shorten the hose life.

### **How should I properly ground my booth?**

Drive the rod vertically into the ground and attach a grounding strap directly to the booth. Contact your local electrical contractor for a standard grounding rod, typically copper.

### **How should I handle pre-coated or recoated parts?**

Pre-coated or recoated parts may already be insulated with 1 to 2 mils of coating. Powder starts to repel itself around 4 to 5 mils. Turn down the gun voltage (Kv), by at least half, to prevent the repelling or back ionization of the new powder material. Also, verify with the powder supplier to ensure proper inter-coat adhesion.

## Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section



**PAINTS AND  
COATINGS  
SKILL COUNCIL**



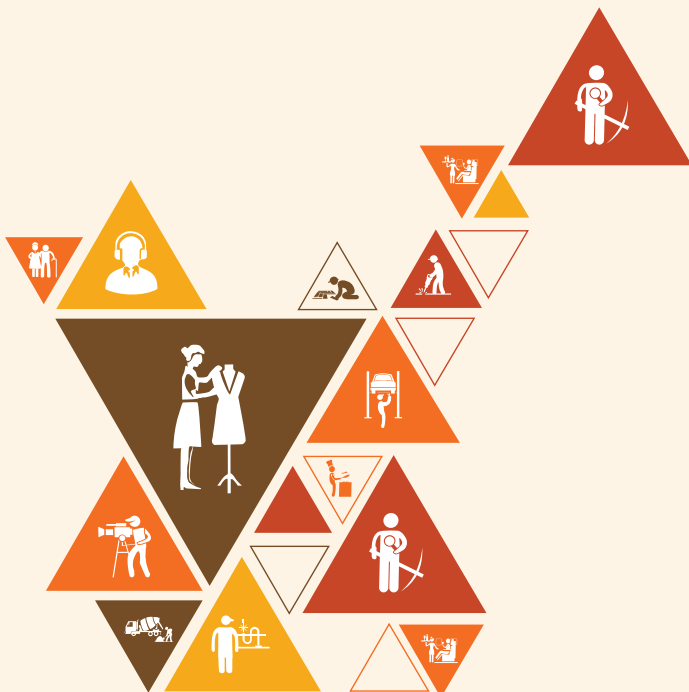
## 8. Maintain OH&S Standards and Follow Environmental Norms

Unit 8.1 – Health hazards of powder coating materials

Unit 8.2 – Use Safety Tools and Personal Protective Equipment

Unit 8.3 – Handling of Powder Coating Materials and Equipment as  
per Safety and Environmental Standards

Unit 8.4 – Precautionary measures



## Key Learning outcomes

At the end of this module, you will be able to:

1. Explain the health hazards of powder coating materials.
2. List the personal protective equipment and its uses for powder coating industry.
3. Describe the safe way to handle powder coating materials and equipment.
4. Explain the precautionary measures for emergencies.



## Unit 8.1: Health Hazards of Powder Coating Materials

### Unit Objectives



At the end of this unit, you will be able to:

1. Explain the health hazards of powder coating materials i.e. chemicals and powders.
2. Explain the other health hazards of working in a plant setting.

## 8.1.1 Health Hazards of Powder Coating Materials

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- A hazard is a source of potential harm, injury or detriment.
- The health and safety initiative of a company is to prevent accidents and injury which may occur due to handling of hazardous materials or operating equipment.
- For a powder coater, the risks may include dust inhalation, eye strain, poor posture leading to back and shoulder problems, long working hours and accidents with machine/ tools.
- Spot and report potential hazard on time and effectively communicate to the appropriate authority.
- The international standard OHSAS 18001 Occupational Health and Safety Management Systems (OHSMS), grew from the need for managing safety in the work environment. The standard was created from the British Standard for Occupational Health and Safety Management Systems BS 880, and is similar in its structure to the ISO 9000 (for quality) and ISO 14000 (for environment) series of standards.

### Notes for Facilitation

- Find out from the students what do they understand from hazardous materials.
- You could ask the students to list out hazardous materials they use in everyday life and what safety measures are adopted to prevent injury and accident.
- List the equipment, machine, tools and materials used for powder coating and the care needed while handling them to prevent injury and accident.
- Give examples to explain the concept.

### Ask

- How important it is to adopt safety and precautionary measures at home and workplace?
- What are the hazardous materials we use in our day to day life?
- What safety measures we adopt in our everyday life?
- Can you think of any difference in the way we adopt safety measures at home and in a factory setting?

## Do



- Make a group of 3- 4 students to discuss what work hazards an employee may face in a powder coating unit.
- Instruct the group to discuss how to spot hazards and communicate effectively to the authorities.
- Each group to discuss what safety measures can be taken to prevent injury and accidents.
- Each group to present the discussion points in front of the class.

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 8.1.2 Materials Safety Data Sheet

### Resources to be Used

- White board, marker, pen, notebook.
- Material safety data sheet.

### Say

- Health problems when handling or using a powder coating may arise through exposure to hazardous substances, which may be contained in the coatings.
- A Material Safety Data Sheet (MSDS) is an information sheet that lists the hazardous ingredients contained in the coating, precautions, and safety measures to be taken during its storage, handling and usage. Measures to be taken in an emergency or in an accident.
- MSDS includes details and information on any hazardous substance (ii) guidance on health hazards associated with the product and substances (iii) guidance on occupational exposure limits (iv) advice on safe handling and use (v) advice on precautions necessary to avoid exposure.
- An MSDS is required for industrial products used in the factory/ workplace like paint, thinners, pretreatment chemicals, cleaners etc.

### Explain

- What is a material safety data sheet (MSDS).
- Why it needs to be studied carefully.
- Where one can get the material safety data sheet.
- Why an MSDS sheet is required for a medical emergency.
- From where additional information can be obtained.

### Notes for Facilitation

- Find out from the students what do they understand from material safety data sheet.
- Give the overview of the material safety data sheet for powder coating.
- List the equipment, machine and tools used for powder coating for which material safety data sheet must be studied carefully.
- Give examples to explain the concept.

## Ask



- Why do you need an MSDS sheet at workplace?
- From where can you get an MSDS sheet?
- Why do you think an MSDS is required during a medical emergency?
- Why do you need additional information other than the information given in an MSDS?
- Who can help you to understand the technical terms mentioned in an MSDS?

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 8.1.3 Waste Disposal

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- Waste disposal is a matter of great concern as it impacts the environment significantly.
- There are different kinds of waste produced from factory and manufacturing units.
- Dumping waste in the open is extremely harmful for the environment and general health.
- All powder coatings are not hazardous waste by definition of the Resources Conservation and Recovery Act regulations (RCRA).
- Disposal methods for waste powder are the same as for non-hazardous wastes. However, there may be some exceptions and the powder supplier should be contacted regarding proper disposal.
- Always renew disposal needs with the local authority having jurisdiction over your facility location.

### Explain

- Different kinds of waste.
- Waste materials generated in homes and in a factory setting.
- Ill effects of dumping waste in the open.
- Correct and legitimate ways to dispose of waste materials.
- The awareness and attitude one must inculcate towards waste disposal.

### Notes for Facilitation

- Find out from the students what do they understand from waste materials.
- You could ask the students to list out waste materials generated in our everyday life and how do they dispose such waste.
- List the materials used for powder coating and the waste materials generated from them.
- List the waste materials generated in a factory setting.
- Discuss the correct and legitimate ways of disposing waste to save the environment and health in general.
- Give examples to explain the concepts.

## Ask



- Why do you think we need to be careful towards waste disposal?
- Do you know anyone who has been irresponsible in dumping waste in your locality?
- Have you even been irresponsible in dumping waste at your home and locality?
- Do you know anyone who is very careful and conscientious while disposing the waste?
- What care one must take at home while disposing the waste?
- What care one must take at one's locality and public places for disposing the waste materials?
- What care you need to take while you work in a factory setting regarding waste disposal?
- What can you do to create awareness at home, in your locality and in the factory where you will work regarding waste material disposal?

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

## Unit 8.2 – Use Safety Tools and Personal Protective Equipment

### Unit Objectives



At the end of this unit, you will be able to:

1. Explain the different types of personal protective equipment mandatory for working in a powder coating application plant.



## 8.2.1 Personal Protective Equipment (PPE):

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- Personal Protective Equipment (PPE) are mandatory to use while working in a factory setting.
- Personal protective equipment, commonly referred to as “PPE”, is equipment worn to minimise exposure to hazards that cause serious workplace injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. Personal protective equipment may include items such as gloves, safety glasses and shoes, earplugs or muffs, hard hats, respirators, or coveralls, vests and full body suits.
- All personal protective equipment should be maintained in a clean and reliable fashion. It should fit comfortably, encouraging worker use. If the personal protective equipment does not fit properly, it can make the difference between being safely covered or dangerously exposed.
- Each employee must be trained to use PPE and must know - when it is necessary, what kind is necessary, how to properly put it on, adjust, wear and take it off, the limitations of the equipment, proper care, maintenance, useful life, and disposal of the equipment

### Notes for Facilitation

- Find out from the students what do they understand from PPE and why it is mandatory in a factory setting
- You could ask the students to list out various protective equipment we use in our everyday life and how it helps our personal safety
- List the PPE used for powder coating and the how it ensures personal safety.
- Give examples to explain the concept.

### Ask

- Why do you think you need to use PPE?
- What care you need to take while you work in a factory setting regarding the use of PPE?
- What can you do to create awareness at workplace and with your co-workers in the factory regarding the use of PPE for personal safety?

### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 8.3. Handling of Powder Coating Materials and Equipment as per Safety and Environmental Standards

### Unit Objectives



At the end of this unit, you will be able to:

1. Describe the safe way of handling powder coating material and equipment.
2. Take Safety precautions from Heat/Ignition sources like poor ground, electrical equipment, matches, cigarettes etc.

### 8.3.1 Handling of Powder Coating Materials

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- The main hazards involved in the electrostatic application of powder coatings are I) dust explosion and fire II) electrical shock III) exposure to hazardous substances IV) compressed air.
- Employees exposed to hazardous substances should be considered for health surveillance per national legislation.
- Powder coatings, being fine organic materials, can give rise to dust explosions. A dust explosion may occur when both: (i) the concentration of dust in the air is between the Lower Explosive Limit (LEL) and Upper Explosion Limit (UEL). (ii) a source of ignition of the required energy for the dust cloud is present.
- Powder coating systems should be designed to prevent both conditions occurring, but due to the difficulty of eliminating sources of ignition, more reliance should be placed on the prevention of explosive concentrations of powder. This can be achieved by ensuring that the powder in air concentration is kept below 50% of the LEL.
- The configuration of the unit and coating powder usage should be regularly checked against stated values to ensure that airborne concentrations do not exceed 10 g/m<sup>3</sup>.
- A regular maintenance and cleaning schedule should be introduced to prevent accumulation and buildup of dusts. In the case of electrical equipment, buildup of dusts can result in their ignition through overheating.
- Where engineering controls are inappropriate or not possible for reducing exposure to the required levels, suitable RPE must be provided. Depending on the circumstances either dust respirators or air fed respiratory equipment will be required. In either case an adequate level of protection must be ensured.
- The use of compressed air or dry brushing for cleaning up spills for cleaning down equipment should be avoided.
- The prevention measures should be taken by installation of properly constructed spray booths with exhaust ventilation equipment to extract dust and maintain airborne concentrations below the LEL (5 mg / m<sup>3</sup>) within the workplace. Where manual application techniques are in use, the direction of the air flow should be from behind the operator, over the workpiece being coated and into the exhaust ducts. These should be situated as close to the workplace as possible.
- If the powder coatings concentration exceeds 10 mg / m<sup>3</sup>, respiratory protective equipment (RPE) should be worn in compliance with the local legislation.
- The operation and effectiveness of extraction and ventilation systems should be inspected, tested and maintained in accordance with national legislation.
- All employees involved in the handling of coating powders should be provided with anti-static coveralls designed to prevent ingress of the powder. Suitable gloves should be provided to minimise skin contact.
- Allergy sufferer and people who have difficulty in breathing should not work in a powder coatings line.

## Notes for Facilitation

- Give the overview of the hazards and risks involved while handling powder coating materials and equipment.
- Discuss the safety measures and preventions necessary to avoid illness, injury and accidents.

## Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

### 8.3.2 Heat/Ignition source – sparks from poor ground, electrical equipment, matches, cigarettes

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- A fire may occur when a layer of deposited powder coating or a cloud comes into contact with an ignition source such as hot surfaces or flames, electrical discharges or sparks, electrostatic discharges. A fire within the powder coating system may result in a dust explosion if either burning particles are allowed to enter confined sections of equipment, such as dust collectors, or if burning dust deposits are disturbed.
- Smoking should be strictly prohibited and all sources of ignition, such as matches and lighters, should be excluded.
- A regular maintenance and cleaning schedule should be introduced to prevent accumulation and buildup of dusts. In the case of electrical equipment, buildup of dusts can result in their ignition through overheating. The temperature of external surfaces, or surfaces liable to be exposed to dust, of electrical equipment should not exceed 270°C. This value is 2/3 of the minimum ignition temperature.

#### Notes for Facilitation

- Give the overview of the ignition sources in a powder coating unit and how to avoid risk of any fire.
- List the equipment, machine and tools used for powder coating which needs to be cleaned and maintained to prevent fire.

#### Ask

- What care we take at our home to avoid any risk of fire?
- What measures can be taken to prevent fire in a powder coating unit?

#### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

### 8.3.3 Safety Rules for Electrical Equipment

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- The main sources of electrical hazard are: (I) inadequate or defective earthing (grounding) systems leading to build-up of static and subsequent sparking or shock. (II) breakdown or overheating of the electrical equipment leading to fire or shock.
- The contact between the work part, carrier jigs and conveyor should be designed and regularly tested to ensure an adequate earth is maintained at all times. Jigs should be designed to avoid any unnecessary build-up of coating. They should be cleaned on a regular basis to maintain correct contact. Automatic cut-out or warning systems should be installed, wherever practicable, to constantly monitor the efficiency of the earthing system between the jig and the conveyor.
- As an additional precaution, all components of the spraying facility should be connected through an equipotential bonding system. This should include all electrical equipment enclosures, metal floors, ceilings, fences, partitions, and conveyors as well as the HV generator.
- As an alternative to physical earthing of the workpiece, ionizing devices can be used to discharge any accumulated electrostatic charges. The device should be sited as near as possible to the work piece.
- Regular maintenance and cleaning programs should be introduced to ensure that dusts are not allowed to build up on electrical equipment and that ventilation ducts and cooling fins are kept clean and unobstructed.
- Only the spray gun(s) and associated electrical cables and powder supply hoses should be sited inside the booth.
- Operatives should wear anti-static overalls, non-insulating gloves and anti-static footwear meeting the requirements of ISO 2033/2024.

#### Notes for Facilitation

- Give the overview of the dangers involved with electrical equipment in a powder coating unit and how to avoid risk of accidents.
- List the electrical equipment, machine and tools used for powder coating which needs to be cleaned and maintained to prevent accidents.

#### Ask

- What care we take at our home to avoid any risk from electrical equipment?
- What measures can be taken to prevent accident risks from electrical equipment at a powder coating unit?

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

### 8.3.4 Bake Oven Safety Rules

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- Ovens should be inspected, tested and maintained to ensure their operational effectiveness.
- Installation and design of stoving ovens should be such that any by-products or volatile components are exhausted to a safe place and prevented from escaping or returning into the work area.

#### Notes for Facilitation

- Give the overview of the dangers involved with cure ovens in a powder coating unit and how to avoid risk of accidents.
- List the areas of powder coating cure ovens which needs to be cleaned and maintained to prevent accidents.

#### Ask

- What measures can be taken to prevent accident risks from cure ovens at a powder coating unit?

#### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.



## Unit 8.4: Precautionary Measures

### Unit Objectives



At the end of this unit, you will be able to:

1. Learn about the ergonomic lifting, bending and moving equipment.
2. List what goes into a first aid kit.
3. Learn the actions to take during emergency procedures.
4. Identify different kind of safety signs.

## 8.4.1 Ergonomic lifting, bending or moving equipment and supplies

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- Scientific evidence shows that effective ergonomic interventions can lower the physical demands of manual material handling work tasks, thereby lowering the incidence and severity of the musculoskeletal injuries they can cause.
- Manual material handling tasks may expose workers to physical risk factors. If these tasks are performed repeatedly or over long periods of time, they can lead to fatigue and injury.
- The main risk factors, or conditions, associated with the development of injuries in manual material handling tasks include I) Awkward postures (e.g., bending, twisting) II) Repetitive motions (e.g., frequent reaching, lifting, carrying) III) Forceful exertions (e.g., carrying or lifting heavy loads) IV) Pressure points (e.g., grasping [or contact from] loads, leaning against parts or surfaces that are hard or have sharp edges) V) Static postures (e.g., maintaining fixed positions for a long time).
- Productivity gets an additional and solid boost when managers and workers take a fresh look at how best to use energy, equipment, and exertion to get the job done in the most efficient, effective, and effortless way possible.
- Ergonomic principles recommend eliminating lifting from the floor and using simple transport devices like carts or dollies, using lift-assist devices like scissors lift tables or load levelers, using more sophisticated equipment like powered stackers, hoists, cranes, or vacuum assist devices.

### Notes for Facilitation

- Give the overview of the dangers involved with not following ergonomic principles of lifting, bending, moving equipment in a powder coating unit and how to avoid risk of injury and accidents.
- Discuss the most effective, efficient and effortless ways of lifting, bending and moving equipment in a powder coating unit.
- Relate the concept with the participant's experience of how care is taken while moving heavy objects at our homes.

### Ask

- What measures can be taken to prevent injury and accident risks by following the ergonomic principles of lifting, bending and moving equipment and heavy objects.

### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 8.4.2 First Aid

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- First aid is the assistance or help given to a sick or injured person until full medical treatment is available.
- It includes initial intervention in a serious condition prior to professional medical help being available, such as performing CPR while awaiting an ambulance, as well as the complete treatment of minor conditions, such as applying a plaster to a cut. First aid is generally performed by the layperson.
- CPR stands for cardio-pulmonary resuscitation; it helps maintain the flow of oxygenated blood.
- The key aim of first aid is to preserve life, prevent further harm and promote recovery.
- Technically, it is not classified as medical treatment and should not be compared to what a trained medical professional might do. First aid is a combination of some simple procedures, plus the application of common sense.
- Primary survey is known as DRAB (danger, response, airway, breathing).
- Danger- check for dangers to the casualty and to you as a first aider. If there is danger present, can you get rid of the danger, or move the casualty from the danger? If there is nothing you can do, stay away and get professional help. The worst thing a rescuer can do is become another victim.
- Response- if safe to approach, is the casualty conscious? See if the patient is alert, ask questions and see if you get a response, find out whether he/she responds to your touch. Very well trained first aiders will know how to find out whether the casualty responds to pain.
- Airway- is the casualty's airway open and clear? If not try to clear it. Trainers advice first aiders to have the casualty lying on their back, and then to place one hand on his/her forehead and place two finger from the other hand on the casualty's chin and gently tilt the head back while slightly raising the chin further upwards. Any obstructions need to be removed from the casualty's mouth, including dentures. First aiders are trained only to put their fingers in the casualty's mouth if they can see an obstruction there.
- Breathing- is the casualty breathing effectively? The first aider should look at the chest for movement, his/her mouth for signs of breathing (e.g. sounds), and get close to the casualty and see if air exhalation can be felt on the first aider's cheek.
- The Secondary Survey - DOMS (deformities, open wounds, medic alert tags, swellings) If the casualty is breathing adequately, then it is possible to carry out a Secondary Survey. This is a rapid whole body check. As soon as this has been done, the casualty should be placed in a recovery position. At this point the first aider should call for an ambulance.

## Notes for Facilitation



- Give the overview of the importance and use of first aid at the workplace.
- Discuss the situations where first aid can be administered at workplace.
- Relate the concept with the participant's experience of how care is taken if someone gets injured or ill at our homes.

## Ask



- Why first aid kit is important at workplace.
- How and in what situations first aid can be administered at the workplace.
- What care one must take while administering first aid.

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

### 8.4.3 Emergency Procedures

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- Nobody expects an emergency or disaster. Yet the truth is that emergencies and disasters can strike anyone, anytime, and anywhere.
- A workplace emergency is an unforeseen situation that threatens employees, customers, or the public; disrupts or shuts down your operations; or causes physical or environmental damage. Emergencies may be natural or manmade and include - floods, hurricanes, tornadoes, fires, toxic gas releases, chemical spills, radiological accidents, explosions, civil disturbances, and workplace violence resulting in bodily harm and trauma.
- The best way is to prepare to respond to an emergency before it happens. Few people can think clearly and logically in a crisis, so it is important to do so in advance.
- An emergency plan must include a way to alert employees, including disabled workers, to evacuate or take other action, and how to report emergencies, as required.
- An emergency plan must include preferred method for reporting fires and other emergencies, an evacuation policy and procedure, emergency escape procedures and route assignments, such as floor plans, workplace maps, and safe or refuge areas.
- The company must determine potential hazards and the appropriate controls and protective equipment for those hazards. Personal protective equipment for emergency may include items such as - Safety glasses, goggles, or face shields for eye protection, hard hats and safety shoes for head and foot protection, proper respirators, chemical suits, gloves, hoods, and boots for body protection from chemicals, special body protection for abnormal environmental conditions such as extreme temperatures; and any other special equipment or warning devices necessary for hazards unique to the worksite.

#### Notes for Facilitation

- Find out from the students what according to them are emergency situations.
- Give the overview of the prevention measures taken by companies to deal with the emergency situations.

#### Ask

- What do you understand by a workplace emergency?
- What is an emergency action plan?
- What PPE can be used during emergency?

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 8.4.4 Display Safety Signs

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- Safety signs must be used whenever a hazard or danger cannot be avoided adequately or reduced in another way. Before installing safety signs an employer should examine whether the hazard can be avoided or reduced by collective precautions (precautions that protect everybody) or safer ways of doing the work.
- A safety sign provides information about safety or health and can be a signboard, colour, acoustic signal, verbal communication, or hand signal.
- Safety signboards should not contain text. This is because the symbols or pictograms on a signboard are intended to be understood, independently of the language ability of the worker viewing it.
- Employers must provide information to employees on the meaning and requirements of any signs used in the workplace, especially where text on supplementary signboards is used.
- The colours and shapes used in safety signs - red for prohibition, yellow for caution, green for positive action, blue for mandatory actions, O discs for prohibitions and instructions, Δ Triangles for warnings, □ Squares and rectangles for emergency and information signs.

### Notes for Facilitation

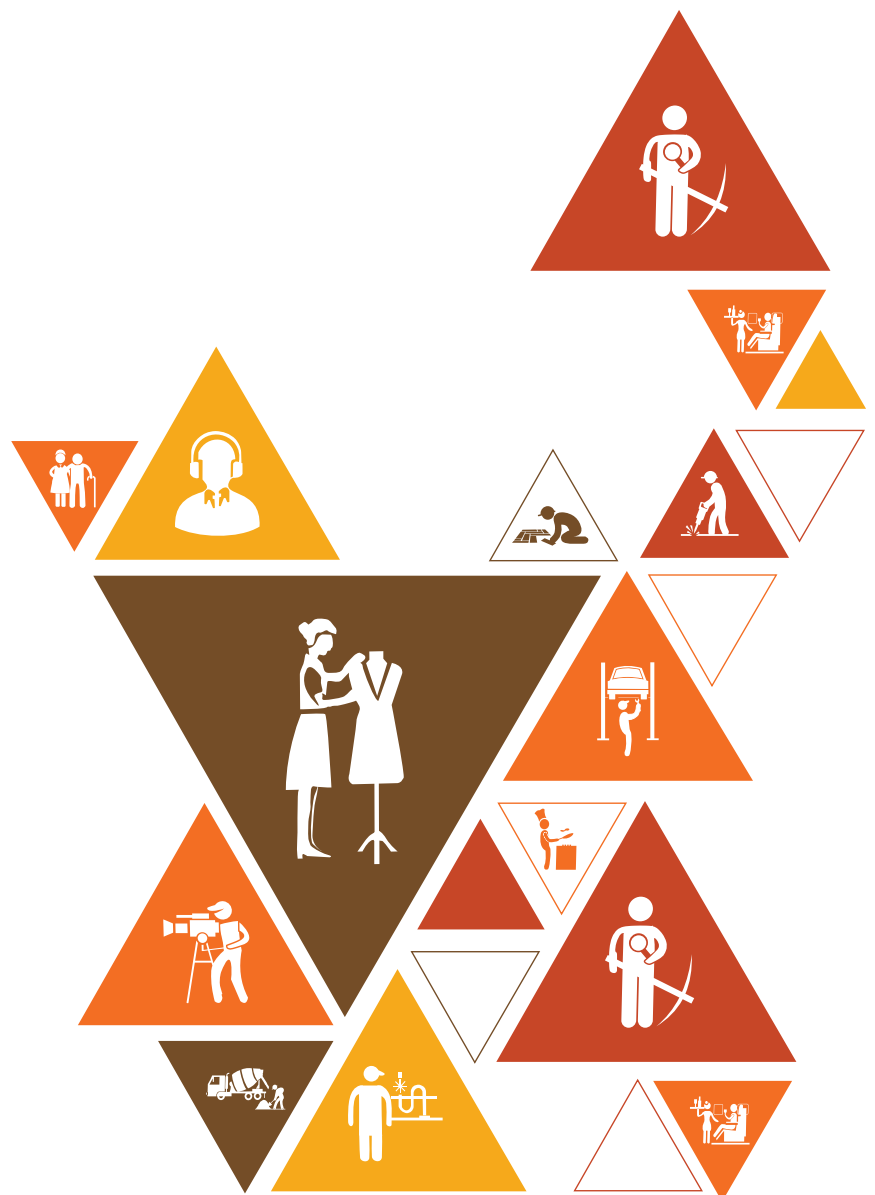
- Find out from the students what do they understand from safety signs.
- Give the overview of the different kinds of safety signs used in the workplace.
- List the areas in the powder coating facility, equipment, machine and tools for which safety signs are used.

### Ask

- What are the benefits of a safety sign?
- What colours and shapes should be used on safety signboards?
- When must safety signs be used?

### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.





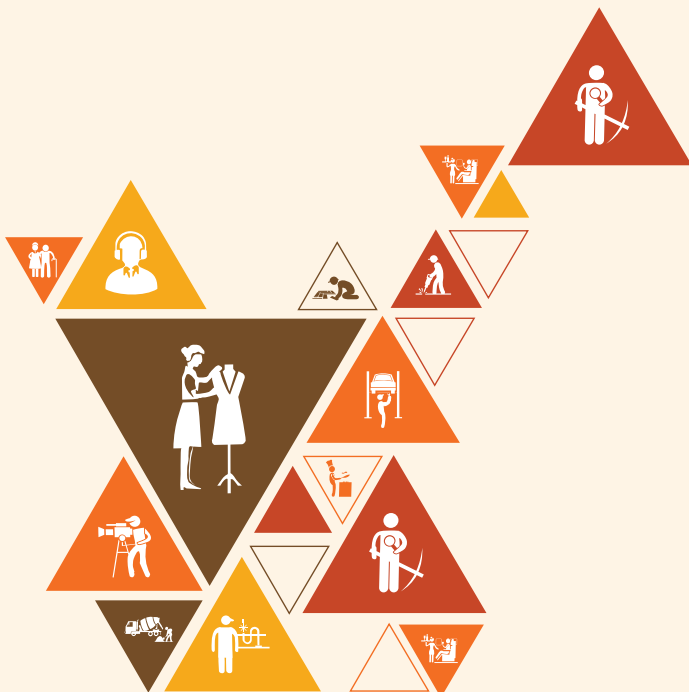
PAINTS AND  
COATINGS  
SKILL COUNCIL



## 9. Maintain IPR of Organization and Customer

Unit 9.1 – Secure Company's IPR

Unit 9.2 – Respect Customer's Copyright



## Key Learning outcomes

At the end of this module, you will be able to:

1. Explain the meaning of Intellectual Property Rights.
2. Explain about confidential information and trade secrets.
3. List out the Do's and Don'ts to keep the company and customer information confidential.

## Unit 9.1: Secure Company's Intellectual Property Rights (IPR)

### Unit Objectives



At the end of this unit, you will be able to:

1. Explain what is IPR, Patent, Trademark, Copyright, Non-Disclosure Agreement and confidential information.

## 9.1.1 Intellectual Property Right (IPR)s

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- IPR is a general term covering patents, copyright, trademark, Industrial designs, geographical indications, protection of layout design of integrated circuits and protection of undisclosed information known as trade secrets.
- An industrial Design is an aesthetic aspect of an article. The design may consist of three dimensional features, such as the shape of an article, or two dimensional features such as patterns, lines or colours.
- Industrial Designs are applied to a wide variety of products of Industry and Handicrafts such as technical and medical instruments, watches, jewellery, house ware, electrical appliances, vehicles, architectural structures, textile designs and other luxury items.
- Industrial Design is primarily of an aesthetic nature and does not protect any technical features of the article to which it is applied.
- Registration of Industrial design gives the right to exclusive use of the design, right to protect the design from piracy, and usage of rights even against the government.
- A trademark is a recognizable sign, design or expression which distinguishes products or services of a particular trader from the similar products or services of other traders. For example, the products sold by Asian Paints company bears the logo of the company. The same logo cannot be used by any other company as it is the exclusive trademark of Asian Paints.
- Trademark infringement occurs when one party uses a trademark that is identical or confusingly similar to a trademark owned by another party.
- Registering a trademark provides legal advantages for enforcement. Infringement can be addressed by civil litigation and, in several jurisdictions, under criminal law.
- Violation of intellectual property rights, called “infringement” may be a breach of civil law or criminal law, depending on the type of intellectual property involved, jurisdiction, and the nature of the action.
- Example - A publisher may own Copyright in a book which has been reproduced and sold without his/her consent, at a cut price.
- Example - A sound producer, who has invested large amounts of money in terms of talent and technical skills, in producing a record, sees that copies of it are sold on the market, at cheap prices without his authorization.
- Example - Someone else’s trademark may have been used by a company on similar or identical goods of lesser quality resulting in serious financial loss for the company and deceiving the customers.

## Explain



- Intellectual Property Rights (IPR).
- Protect infringement of company IPR.
- Consult supervisor or senior management when in doubt about using information concerning company IPR.
- Report any infringement observed by anyone in the company.
- Prevent leak of new plans and designs to competitors by reporting on time.
- Be aware of any of company's product or design patents.
- Report IPR violations observed in the market, to supervisor or company head.

## Notes for Facilitation



- Find out from the students what do they understand from Intellectual Property Rights(IPR). Give them example of new movies, new mobile handsets and other products and how the respective companies want to protect the design, look and other features.
- You could make the students discuss the meaning and importance of IPR. Invite few students to present in front of the class.
- You could make the students discuss the meaning and importance of Industrial design. Invite few students to present in front of the class.
- You could make the students discuss the meaning and importance of Trademark. Invite few students to present in front of the class.
- You could make the students discuss in pairs the meaning of IPR infringement. Invite few students to present in front of the class.

## Ask



- Have you ever bought a product with a fake trademark?
- Have you ever watched a movie on internet which has been newly released in the cinema halls?
- Have you ever been to a market where cheap imitations of famous brands are sold like T-shirts, shoes, handbags, jewellery etc.

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 9.1.2 Copyright

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- A copyright gives the creator of an original work exclusive rights to it, usually for a limited time.
- Copyright may apply to a wide range of creative, intellectual, or artistic forms, or “works”.
- Copyright does not cover ideas and information themselves, only the form or manner in which they are expressed.
- A copyright is violated when someone reproduces, distributes, displays or performs a work without the permission from the original creator.
- Copyright enforcement is the responsibility of the copyright holder.

### Notes for Facilitation

- Find out from the students what they understand from copyright. Give them examples of new movies, or new movie songs released recently.
- You could make the students discuss in pairs the meaning and importance of copyright. Invite few students to present in front of the class.
- Give them examples of copyright from the workplace related to the powder coating industry.

### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

### 9.1.3 Confidential Information and Trade Secrets

#### Resources to be Used

- White board, marker, pen, notebook.

#### Say

- In this information age, it's imperative that a business protects its new formula, product, technology, customer lists, or future business plans.
- Every company has their own systems and processes which works for them. These trade secrets are valuable to the company as it significantly contributes to the success of the company hence every company wants to protect these secrets and other confidential information.
- In order to protect trade secrets and confidential information, watertight agreements are signed by the employees.
- In order to ensure that the rights of third parties are not violated, non-disclosure agreements are signed. These agreements clearly state that the employee is not to disclose the information given by the third party under any circumstances to anyone other than those who legitimately may require the information to complete the work given by the third party.

#### Notes for Facilitation

- Find out from the students what do they understand from confidential information and trade secret.
- Give the overview of the confidential information and trade secrets of a powder coating factory.
- You could make the students discuss in pairs the meaning and importance of trade secrets and confidential information. Invite few students to present in front of the class.

#### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 9.2. Respect Customer's Copyright

### Unit Objectives



At the end of this unit, you will be able to:

1. List out the do's and don'ts related to confidential information and copyright of your company.
2. List out the do's and don'ts related to confidential information of the customers.



## 9.2.1 Organization information to be kept confidential

### Resources to be Used

- White board, marker, pen, notebook.

### Say

- Intellectual property is created by most companies, whatever business they are involved in. For many of these organisations, intellectual property is even their most important asset.
- Safeguarding IPR for a company can result into obtaining higher returns on their investments, since owning intellectual property rights may not only enhance the bargaining power, but may also be exploited through licences in return for royalty payments.
- It is important to protect the IPR of the company to enhance the market value and increase future profit expectations in the eyes of investors and financing institutions.
- Be aware of your company's registered brand names, slogans, logos, registered design patents licensing technology to others etc.
- Protect the documents of the company by watermarking and putting appropriate logos and company stamps.
- Do not share company information over the email to people outside organization.
- Be careful of what you post about your company on the micro blogging site like Facebook, Twitter and LinkedIn.

### Explain

- Read and understand customer non-disclosure agreement.
- Protect infringement upon customer's business or design plans.
- Consult supervisor or senior management when in doubt about using information available from customer.
- Report any infringement observed by anyone in the compan.

## Notes for Facilitation



- Find out from the students why organization information regarding IPR needs to be kept confidential.
- Give the overview of the production process for powder coating.
- List the equipment, machine and tools, designs and processes used for powder coating factory which a company wants its employees to keep confidential.
- You could make the students discuss in pairs why and how they should be aware of the company's IPR and patented products. Invite few students to present in front of the class.
- You could make the students discuss in pairs why and how they can identify and stop plagiarism and piracy for their company patents. Invite few students to present in front of the class.

## Summarize



- You can recap by asking participants to recall the key points and thereafter summarising the section.

## 9.2.2 Customer information to be kept confidential

### Resources to be Used

- White board, marker, pen, notebook.

### Say

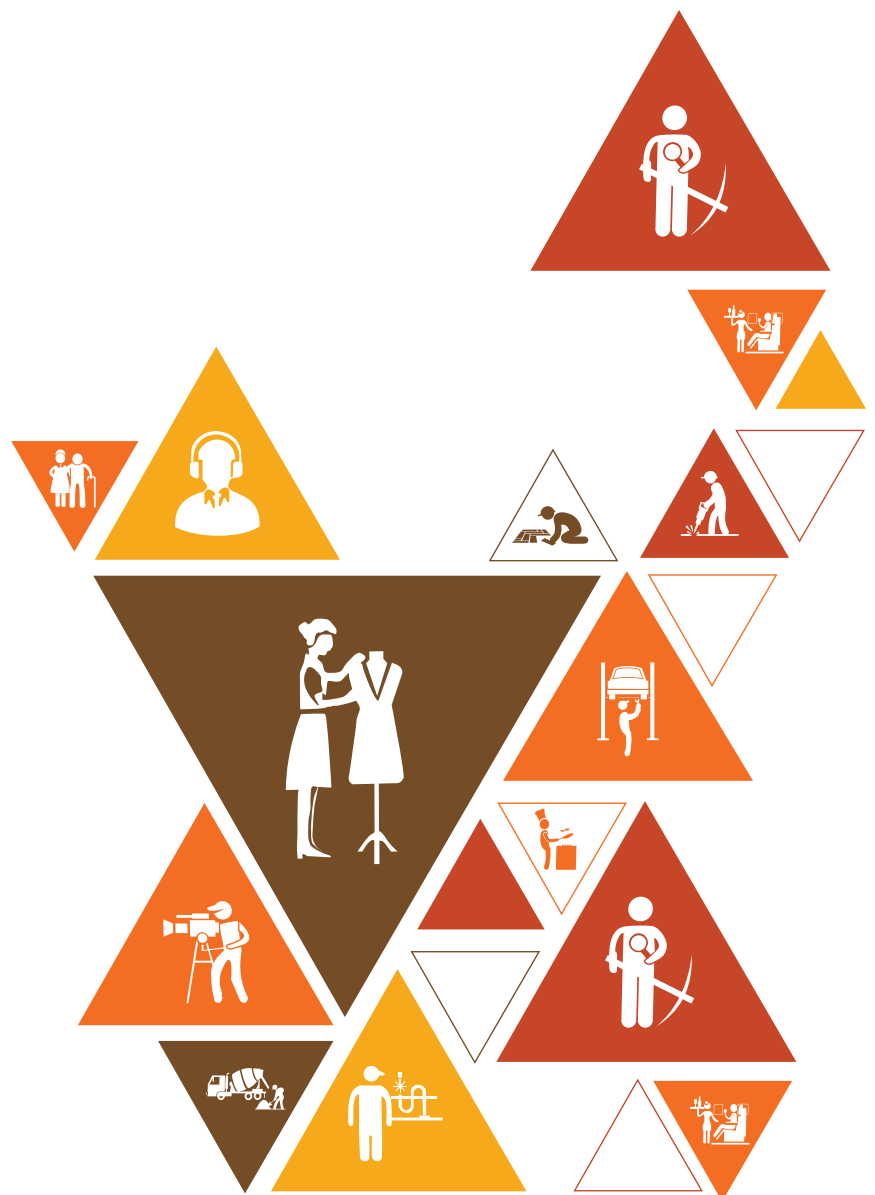
- 'Plagiarism' is an act of fraud. It involves both stealing someone else's work and lying about it afterward.
- Keep your eyes and ears open to any kind of infringement you may find in terms of trademark, trade secret, copyright of your customer's products.
- Report plagiarism to your authorities immediately.
- Keep the customer information on new products, product launches, policies and procedures a secret. Do not discuss with anyone other than the people in the organization who are privy to this information.
- Be careful of what you post about your company on the micro blogging site like Facebook, Twitter and Linked in.

### Notes for Facilitation

- Find out from the students why customer or third party information should be kept confidential.
- Give the overview of the customer information which needs to be kept confidential for a powder coating factory.
- List the equipment, machine and tools, design and processes used for the customer or third party powder coating which are to be kept confidential.
- You could make the students discuss in pairs why and how they should be aware of the customer's IPR and patented products. Invite few students to present in front of the class.
- You could make the students discuss in pairs why and how they can identify and stop plagiarism and piracy for their customer's patents. Invite few students to present in front of the class.

### Summarize

- You can recap by asking participants to recall the key points and thereafter summarising the section.



**PAINTS AND  
COATINGS  
SKILL COUNCIL**

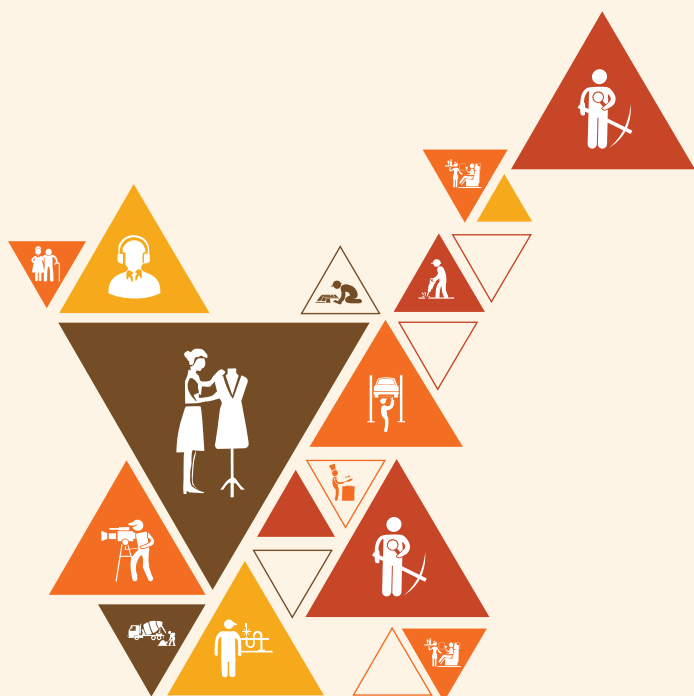


## 10. Annexures

Annexure I: Training Delivery Plan

Annexure II: Assessment Criteria

Annexure III: Glossary



## Annexure I

### Training Delivery Plan

Training Delivery Plan			
Program Name:		Certificate Course in Powder Coating Application	
Qualification Pack Name & Ref. ID		Powder Coater - PCS/Q5102	
Version No.	1.1	Version Update	04/11/2016
		Date	
Pre-requisites to Training (if any)		Preferably Class X / the ability to read/write and communicate effectively for the job role	
Training Outcomes		<b>By the end of this program, the participants will be able to:</b>	
Version Update Date		<ol style="list-style-type: none"> <li>1. Explain the evolution and growth of the paints and coating industry.</li> <li>2. Demonstrate core skills, professional skills, and generic skills required for a powder coater job role.</li> <li>3. Illustrate understanding of a total powder coating plant facility.</li> <li>4. Study the drawing and production plan, the coating required, verifying details with the customer and prepare jigging.</li> <li>5. Describe cleaning the surface, loading prepared sections on conveyor and pretreatment for coating.</li> <li>6. Learn about powder coating the sections, quality check of powder coated sections, curing of parts, packing and dispatch.</li> <li>7. Learn about maintaining pre-treatment bath, paint booth, tools and equipment.</li> <li>8. Learn about communicating effectively with superiors, colleagues and/or customers to achieve a smooth workflow.</li> <li>9. Learn about understanding accepted levels of standards of product quality or customer service and executing the designated work in a manner that results in 100% satisfaction.</li> <li>10. Learn about following workplace safety standards to have a hazard-free environment and avoid downtime because of disruption from personal injuries and hazardous system failures.</li> <li>11. Learn about securing intellectual property rights (IPR) of the employee's organisation and respecting customer's copyright.</li> </ol>	

Sl. No	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools/ Aids	Duration
1	Introduction and Course Overview	Icebreaker	<ul style="list-style-type: none"> <li>Getting to know each other</li> </ul>		<ul style="list-style-type: none"> <li>Group Activity: Icebreaker</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, playing ball</li> </ul>	0.5 hours
2	Paints and Coatings Sector	Paints and coatings sector in India	<ul style="list-style-type: none"> <li>Understand the trends of the industry</li> </ul>	NA	<ul style="list-style-type: none"> <li>Instructor Lead Training, question based discussion</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Audio-Visual Aid</li> </ul>	1 hours
3	Career Progression	Career path of a powder coater	<ul style="list-style-type: none"> <li>Getting to know the opportunities and prospects for powder coaters</li> </ul>	NA	<ul style="list-style-type: none"> <li>Instructor Lead Training, question based discussion</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker</li> </ul>	0.5 hour
4	Basics of Powder Coating	Basics of powder coating	<ul style="list-style-type: none"> <li>Describe basic concepts, characteristics and uses of powder coating</li> </ul>	PCS/N5105 KB2, KB3, KB4, KB5, PC6	<ul style="list-style-type: none"> <li>Instructor Lead Training, practical demonstration</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, components of powder</li> </ul>	3-hour theory, 3.5-hour practical
5	Study the drawing and production plan	Study the drawing, production plan and jigging required	<ul style="list-style-type: none"> <li>Study and understand the production plan</li> </ul>	PCS/N5105 PC1, PC2, PC3, PC4, PC5, PC8, PC9, PC10, PC11, PC12, PC13, PC14	<ul style="list-style-type: none"> <li>Instructor Lead Training, practical demonstration</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Lab/Factory</li> </ul>	1 hour theory, 3.5-hour practical
6	Study the coating required	Colour theory and different types of finish in powder coating	<ul style="list-style-type: none"> <li>Explain the colour theory</li> <li>Describe finish required</li> </ul>	PCS/N5105 KB6, PC7	<ul style="list-style-type: none"> <li>Instructor Lead Training, practical demonstration</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Lab/Factory</li> </ul>	1 hour theory, 3-hour practical
7	Pre-treatment Process	Pretreatment methods and problems during pre-treatment	<ul style="list-style-type: none"> <li>Describe the pretreatment process for powder coating</li> </ul>	PCS/N5106 KB7, PC1, PC2, PC3, PC4, PC5, PC6, PC7, PC8, PC9, PC10, PC11, PC12, PC13	<ul style="list-style-type: none"> <li>Instructor Lead Training, practical demonstration</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Audio-Visual Aid, Lab/Factory</li> </ul>	17-hour theory, 25-hour practical
8	Know Company's Policy and Work Standards	Company standards and customer specifications	<ul style="list-style-type: none"> <li>Follow company's quality standards</li> </ul>	PCS/N5106 KB7, PC15, SA1, SA2, SA3, SA4	<ul style="list-style-type: none"> <li>Instructor Lead Training, practical demonstration</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Lab/Factory</li> </ul>	3-hour theory, 5-hour practical
9	Powder Coating Application	Powder coating application process, recovery system, tools & equipment	<ul style="list-style-type: none"> <li>Explain the process flow for powder coating and the operation of recovery system</li> </ul>	PCS/N5109 KB8, KB9, PC1, PC2, PC3, PC4	<ul style="list-style-type: none"> <li>Instructor Lead Training, practical demonstration</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Audio-Visual Aid, Lab/Factory</li> </ul>	7-hour theory, 10-hour practical
10	Check Quality of Powder Coated Components	Quality checks of the coated film	<ul style="list-style-type: none"> <li>Application problems in powder coating and quality checks</li> </ul>	PCS/N5109 KB11, PC5, PC6, PC7, PC8	<ul style="list-style-type: none"> <li>Instructor Lead Training, practical demonstration</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Audio-Visual Aids, Lab/Factory</li> </ul>	5-hour theory, 10-hour practical

11	Cure the Coated Components	Bake oven design and curing	<ul style="list-style-type: none"> <li>How to calibrate the oven temperature and timer for curing</li> </ul>	PCS/N5109 KB10, PC9, PC10	<ul style="list-style-type: none"> <li>Instructor Lead Training, practical demonstration</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Audio-Visual Aids, Lab/Factory</li> </ul>	7-hour theory, 10-hour practical
12	Pack and Despatch	Packing and despatch	<ul style="list-style-type: none"> <li>How to clean, pack and dispatch the component</li> </ul>	PCS/N5109 PC11, PC12, PC13	<ul style="list-style-type: none"> <li>Instructor Lead Training, practical demonstration</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Audio-Visual Aids, Lab/Factory</li> </ul>	1 hour theory, 2-hour practical
13	Maintain Pre-treatment Baths, Booth and Oven	Pretreatment bath maintenance. Booth maintenance, cleaning before colour change, bake oven inspection and cleaning	<ul style="list-style-type: none"> <li>Explain how to clean and maintain pretreatment bath, coating booth and oven</li> </ul>	PCS/N5108 KB3, PC1, PC2, PC3, PC4	<ul style="list-style-type: none"> <li>Instructor Lead Training, practical demonstration</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Audio-Visual Aids, Lab/Factory</li> </ul>	6-hour theory, 15-hour practical
14	Maintain Powder Coating equipment, facility and jigs	Maintain powder coating tools, equipment, cleaning the jigs and powder coating facility	<ul style="list-style-type: none"> <li>Explain the upkeep and maintenance for powder coating equipment, facility, jigs and hanging devices</li> </ul>	PCS/N5108 KB17, PC5, PC6, PC7, PC8	<ul style="list-style-type: none"> <li>Instructor Lead Training, practical demonstration</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Audio-Visual Aids, Lab/Factory</li> </ul>	6-hour theory, 15-hour practical
15	Understand the Requirements of the Customer	Quality and service orientation	<ul style="list-style-type: none"> <li>Describe steps to understand customer requirements</li> </ul>	PCS/N9901 KA12, PC1, PC2, PC3, PC4, PC5, PC6, PC7	<ul style="list-style-type: none"> <li>Instructor Lead Training, question based discussion</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker Audio-Visual Aids</li> </ul>	2-hour theory
16	Communicate with Colleagues Effectively	Building trust and rules of communication	<ul style="list-style-type: none"> <li>Learn rules of communication and how to build rapport with colleagues and coworkers</li> </ul>	PCS/N9901 KA11, KA13, KA14, KA16, PC8, PC9, PC10, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18	<ul style="list-style-type: none"> <li>Instructor Lead Training, Role Play</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Audio-Visual Aids</li> </ul>	2-hour theory, 1 hour practical
17	Achieve Customer Satisfaction	Steps to achieve customer satisfaction	<ul style="list-style-type: none"> <li>Describe the steps to achieve customer satisfaction</li> </ul>	PCS/N9901 KA15, KA17, PC19, PC20, PC21, PC22, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC39	<ul style="list-style-type: none"> <li>Instructor Lead Training, Role Play</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Audio-Visual Aids</li> </ul>	4-hour theory, 3-hour practical



18	Understand Product/Service Quality Requirements	Target customer and meeting and exceeding customer expectations	<ul style="list-style-type: none"> <li>Describe the target customer and quality standards defined by the company</li> </ul>	PCS/N9902 PC1, PC2, PC3, PC4, PC5, PC6, PC7, PC8, PC9, PC14, PC15, PC16, PC17, PC18	<ul style="list-style-type: none"> <li>Instructor Lead Training, practical demonstration</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Audio-Visual Aids</li> </ul>	6-hour theory, 5-hour practical
19	Achieve Quality Standards	Tests and standards to check quality	<ul style="list-style-type: none"> <li>Describe various tests and their pass/fail criteria</li> </ul>	PCS/N9902 PC10, PC11, PC12, PC13, PC19, PC20	<ul style="list-style-type: none"> <li>Instructor Lead Training, practical demonstration</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Audio-Visual Aids, Lab/Factory</li> </ul>	6-hour theory, 5-hour practical
20	Health Hazards of Powder Coating Materials	Health hazards of coating materials, MSDS and waste disposal	<ul style="list-style-type: none"> <li>Explain the health hazards of powder coating materials and working in a plant setting</li> </ul>	PCS/N9903 KA1, KB13, KB14, KB15, PC1, PC2, PC3, PC4, PC5, PC6, PC7, PC8, PC9	<ul style="list-style-type: none"> <li>Instructor Lead Training, practical demonstration</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Audio-Visual Aids, Lab/Factory</li> </ul>	1 hour theory, 1 hour practical
21	Use safety Tools and Personal Protective Instruments	Safety tools and PPE (personal protective equipment)	<ul style="list-style-type: none"> <li>Explain the different types of personal protective equipment mandatory for a powder coater</li> </ul>	PCS/N9903 PC29, PC30, PC31, PC32, PC33, PC34	<ul style="list-style-type: none"> <li>Instructor Lead Training, practical demonstration</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Audio-Visual Aids, Lab/Factory</li> </ul>	2-hour theory, 2-hour practical
22	Handling of Powder Coating Materials and Equipment as per Safety and Environmental Standards	Safety rules for handling hazardous materials, ignition sources, electrical equipment and bake oven	<ul style="list-style-type: none"> <li>Explain the safety measures to be adopted while handling hazardous materials, ignition sources, electrical equipment and bake oven</li> </ul>	PCS/N9903 KB12, PC10, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC22, PC23, PC24, PC25, PC26, PC27, PC28	<ul style="list-style-type: none"> <li>Instructor Lead Training, practical demonstration</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Audio-Visual Aids, Lab/Factory</li> </ul>	1.5-hour theory, 1 hour practical
23	Precautionary Measures	Ergonomic principles for lifting, bending and moving, actions for emergency and different kinds of safety signs	<ul style="list-style-type: none"> <li>Describe the ergonomic principles of lifting, bending and moving, actions to take during emergency and different types of safety signs</li> </ul>	PCS/N9903 KB16, PC35, PC36, PC37, PC38, PC39, PC40	<ul style="list-style-type: none"> <li>Instructor Lead Training, practical demonstration</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker, Audio-Visual Aids, Lab/Factory</li> </ul>	1.5-hour theory, 1 hour practical

24	Secure Company's IPR	Intellectual property rights, confidential information and trade secrets	<ul style="list-style-type: none"> <li>Explain the meaning of Intellectual property rights, confidential information and trade secrets</li> </ul>	PCS/N9904 KB1, KB2	<ul style="list-style-type: none"> <li>Instructor Lead Training, class activity</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker</li> </ul>	2-hour theory, 2-hour practical
25	Respect Customer's Copyright	Respecting customer's copyright and keeping customer information confidential	<ul style="list-style-type: none"> <li>List the do's and don'ts related to customer information and copyright</li> </ul>	PCS/N9904 SB1, SB2, SB3, SB4, SB5, SB6, SB7, SB8, PC1, PC2, PC3, PC4, PC5, PC6, PC7	<ul style="list-style-type: none"> <li>Instructor Lead Training, class activity</li> </ul>	<ul style="list-style-type: none"> <li>Whiteboard, Marker</li> </ul>	2-hour theory, 2-hour practical

## Annexure II

### Assessment Criteria

#### CRITERIA FOR ASSESSMENT OF TRAINEES

Assessment Criteria for Powder Coating	
Job Role	Powder Coating
Qualification Pack	PCS/Q5102
Sector Skill Council	Paints and Coatings

Assessment outcome (NOS Code and Description)	Assessment criteria (PC)	Total Marks (400)	Out of	Theory	Skill Practical
<b>PCS/N5105</b> <b>Prepare for coating</b>	PC1. study the plan for powder coating	<b>50</b>	4	1.5	2.5
	PC2. study the assembly of the metal segment to be coated		2	0.5	1.5
	PC3. disassemble the segment if it has multiple pieces to be coated separately		2	0.5	1.5
	PC4. remove the pieces which are made up of rubber, plastic, etc.		2	0.5	1.5
	PC5. understand the conditions where segment is to be used, hot, wet, friction		5	2	3
	PC6. study the metal and chemistry required, e.g., pure epoxy, epoxy polyester, pure polyester, polyurethane		5	2	3
	PC7. colour of paint and finish required		5	2	3
	PC8. document the colour, finish and chemistry required, process description and time and effort estimated for the process		3	1	2
	PC9. meet the customer at appropriate time		3	0.5	2.5
	PC10. present the fact file document to the customer and seek approval		3	1	2
	PC11. make necessary changes after discussion and take approval to start the process		3	1	2
	PC12. select the size of jigs for hanging the segments to be prepared for coating		4	1	3
	PC13. hang segments on the jigs		4	1	3
	PC14. check the controls to see if jigs conveyour is in good working condition		5	1.5	3.5
	<b>POINTS</b>		<b>50</b>	<b>16</b>	<b>34</b>
	<b>TOTAL POINTS</b>			<b>50</b>	

	Assessment criteria (PC)	Total Marks (400)	Out of	Theory	Skills Practical
<b>PCS/N5106</b> <b>Pre-treat the section to be powder coated</b>	PC1. use brush to remove dust from the corners	<b>50</b>	1	0.25	0.75
	PC2. fix the buffing pad		2	0.5	1.5
	PC3. pour the chemical for cleaning onto the buffing pad		2	0.5	1.5
	PC4. switch on the buffer		2	0.5	1.5
	PC5. clean the surface by moving buffer machine on the component surface in circular motion		4	1	3
	PC6. load the tanks with chemical and check the concentration of chemicals		5	2	3
	PC7. hang the components on jigs and move towards the pre-treatment tanks		4	1	3
	PC8. set the control of jigs, conveyor speed and temperature		5	2	3
	PC9. dip component in alkaline/acid cleaners to degrease the section		4	1	3
	PC10. rinse the metal in water		4	1	3
	PC11. dip the component in activation solution to convert any chemical on the metal surface to fumes		4	1	3
	PC12. dip the component in phosphatising/ chromating solution to remove rust and formation of blue-grey layer to prevent the metal for corrosion or oxidation		4	1	3
	PC13. final chemical rinse as passivation treatment for further enhancing the anti-corrosion performance of the metal		4	1	3
	PC14. dry metal with hot air		3	0.5	2.5
	PC15. perform cloth test to check moisture		2	0.5	1.5
	<b>POINTS</b>		<b>50</b>	<b>13.75</b>	<b>36.25</b>
	<b>TOTAL POINTS</b>			<b>50</b>	

	Assessment criteria (PC)	Total Marks (400)	Out of	Theory	Skills Practical
<b>PCS/N5108</b> <b>Maintain jigs and parts</b>	PC1. remove surface oils from tank using oil skimmers	<b>50</b>	7	2	5
	PC2. remove particles from the bottom of the tank using bag filtration		7	2	5
	PC3. remove emulsified and suspended oils using ultrafiltration or centrifugation		7	2	5
	PC4. remove deposits from paint booths		7	2	5
	PC5. clean powder hoses		6	1	5
	PC6. remove deposits from powder guns		6	1	5
	PC7. clean jigs after the process is over		5	1	4
	PC8. clean the facility regularly		5	1	4
	<b>POINTS</b>		<b>50</b>	<b>12</b>	<b>38</b>
	<b>TOTAL POINTS</b>			<b>50</b>	

	Assessment criteria (PC)	Total Marks (400)	Out of	Theory	Skills Practical
<b>PCS/N9901 Coordinate with colleagues and/ or customers</b>	PC1. receive job order and instructions from reporting superior	50	0.5	0.0	0.5
	PC2. understand the work output requirements, targets, performance indicators and incentives		2.0	0.5	1.5
	PC3. deliver quality work on time and report any anticipated reasons for delays		2.0	0.5	1.5
	PC4. escalate unresolved problems or complaints to the relevant senior		2.0	0.5	1.5
	PC5. communicate maintenance and repair schedule proactively to the superior		2.0	0.5	1.5
	PC6. receive feedback on work standards		1.0	0.0	1.0
	PC7. document the completed work schedule and handover to the superior		2.0	0.5	1.5
	PC8. exhibit trust, support and respect to all the colleagues in the workplace		1.0	0.25	0.75
	PC9. aim to achieve smooth workflow		2.0	0.5	1.5
	PC10. help and assist colleagues with information and knowledge		1.0	0.0	1.0
	PC11. seek assistance from the colleagues when required		1.0	0.25	0.75
	PC12. identify the potential and existing conflicts with the colleagues and resolve		1.0	0.25	0.75
	PC13. pass on essential information to other colleagues on timely basis		1.0	0.0	1.0
	PC14. maintain the etiquette, use polite language, demonstrate responsible and disciplined behaviours to the colleagues		2.0	0.5	1.5
	PC15. interact with colleagues from different functions clearly and effectively on all aspects to carry out the work among the team and understand the nature of their work		1.0	0.25	0.75
	PC16. put team over individual goals and multi task or share work where necessary supporting the colleagues		2.0	0.0	2.0
	PC17. highlight any errors of colleagues, help to rectify and ensure quality output		1.0	0.25	0.75
	PC18. work with cooperation, coordination, communication and collaboration, with shared goals and supporting each other's performance		1.0	0.0	1.0
	PC19. ask more questions to the customers and identify their needs		1.0	0.25	0.75
	PC20. possess strong knowledge on the product, services and market		2.0	0.5	1.5

	Assessment criteria (PC)	Total Marks (400)	Out of	Theory	Skills Practical
	PC21. brief the customers clearly on potential costs and hazards		1.0	0.25	0.75
	PC22. communicate with the customers in a polite, professional and friendly manner		1.0	0.25	0.75
	PC23. build effective but impersonal relationship with the customers		0.5	0.25	0.25
	PC24. ensure the appropriate language and tone are used with customers		1.0	0.25	0.75
	PC25. listen actively and have a two-way communication		1.0	0.25	0.75
	PC26. be sensitive to the gender, cultural and social differences such as modes of greeting, formality, etc.		1.0	0.25	0.75
	PC27. understand the customer expectations correctly and provide the appropriate products and services		2.0	0.5	1.5
	PC28. understand the customer dissatisfaction and address or escalate their complaints effectively		2.0	0.5	1.5
	PC29. maintain a positive, sensible and cooperative manner all time		1.0	0.25	0.75
	PC30. ensure to maintain a proper body language, dress code, gestures and etiquettes towards the customers		1.0	0.25	0.75
	PC31. avoid interrupting the customers while they talk		1.0	0.0	1.0
	PC32. ensure to avoid negative questions and statements to the customers		1.0	0.0	1.0
	PC33. inform the customers on any issues or problems before hand and on the developments involving them		2.0	0.5	1.5
	PC34. ensure to respond back to the customer immediately for their voice messages, e-mails, apps, etc.		1.0	0.0	1.0
	PC35. develop good rapport with the customers and promote other products and services		2.0	0.5	1.5
	PC36. seek feedback from the customers on their understanding to what was discussed		1.0	0.0	1.0
	PC37. explain the terms and conditions clearly		2.0	0.5	1.5
	<b>POINTS</b>		<b>50</b>	<b>10</b>	<b>40</b>
	<b>TOTAL POINTS</b>			<b>50</b>	

	Assessment criteria (PC)	Total Marks (400)	Out of	Theory	Skills Practical
<b>PCS/N9902 Maintain standards of product/ service quality</b>	PC38. keep in mind the profiles of expected customers	<b>50</b>	2.0	0.5	1.5
	PC39. understand the target customers and their product/ service quality requirements as defined by the company		3.0	0.5	2.5
	PC40. receive superior's/ customer feedback regularly		2.0	0.0	2.0
	PC41. aim to build a good connect with the customers through quality product/ service		2.0	0.5	1.5
	PC42. keep tab on frequent discussions with regular customers on general likes and dislikes in the market, latest trends, customer expectations, etc.		2.0	0.5	1.5
	PC43. receive updates on regular feedbacks from the clients on current service, complaints, and improvements to be made, etc.		2.0	0.5	1.5
	PC44. if necessary, compulsively seek customer rating of product/ service in order to help develop a set of regularly improved procedures		2.0	0.5	1.5
	PC45. demonstrate quality orientation at all level		4.0	1.5	2.5
	PC46. aim to gain their long-lasting loyalty through satisfaction		3.0	1.0	2.0
	PC47. ensure 100% customer satisfaction via product/ service quality		3.0	0.5	2.5
	PC48. treat the customers fairly and with due respect		3.0	0.5	2.5
	PC49. focus on executing company's marketing strategies and product development needs		3.0	1.0	2.0
	PC50. focus on enhancing brand value of company by maintaining or enhancing quality standards		3.0	1.0	2.0
	PC51. ensure that customer expectations are met		2.0	0.5	1.5
	PC52. learn to read customers' needs and wants		2.0	0.5	1.5
	PC53. willingly accept and implement new and innovative products and services that help improve customer satisfaction		3.0	1.0	2.0
	PC54. communicate feedback of customer to senior, especially, the negative feedback		2.0	0.5	1.5
	PC55. maintain close contact with the customers and focus groups		2.0	0.5	1.5
	PC56. offer promotions to improve product satisfaction level to the customers periodically		3.0	1.0	2.0
	PC57. weigh the cost of fulfilling unscheduled customer requests, consult with senior and advise the customer on alternatives		2.0	0.5	1.5
	<b>POINTS</b>		<b>50</b>	<b>13</b>	<b>37</b>
	<b>TOTAL POINTS</b>			<b>50</b>	

	Assessment criteria (PC)	Total Marks (400)	Out of	Theory	Skills Practical
<b>PCS/N9903</b> <b>Maintain O&amp;HS standards and follow environmental norms</b>	PC1. assess the various health, safety and environmental hazards in the work areas	50	1.5	0.4	1.1
	PC2. take necessary steps to eliminate or minimize the hazards		1.0	0.4	0.6
	PC3. analyse the causes of accidents at the workplace		1.5	0.4	1.1
	PC4. suggest measures to prevent such accidents from taking place		1.5	0.4	1.1
	PC5. take preventive measures to avoid risk of burns and other injury due to contact with hot surfaces, gas, fire, hot fluids/ liquids, etc.		1.5	0.4	1.1
	PC6. suggest methods to improve the existing safety procedures at the workplace		1.5	0.4	1.1
	PC7. dispose waste in the designated areas safely as per company's policies and rules		1.5	0.4	1.1
	PC8. maintain appropriate ventilation in the rooms while there is more exposure to paint vapours		1.0	0.4	0.6
	PC9. avoid dumping unused cans to safeguard the environment		1.0	0.0	1.0
	PC10. be aware of the locations of fire extinguishers, emergency exits, etc.		1.0	0.4	0.6
	PC11. practice correct emergency procedures		1.5	0.4	1.1
	PC12. check and review the storage areas frequently		1.5	0.4	1.1
	PC13. stack items in an organised way and use safe lifting techniques to reduce risk of injuries from handling procedures at the storage areas		1.5	0.4	1.1
	PC14. ensure to be safe while handling materials, tools, acids, chemicals, equipment, etc.		1.0	0.4	0.6
	PC15. store the chemicals and acids in a well-ventilated and locked areas with warning signs displayed		1.5	0.4	1.1
	PC16. ensure safe techniques while moving furniture and fixtures		1.5	0.4	1.1
	PC17. ensure to reduce risk of injury from use of electrical tools		1.5	0.4	1.1
	PC18. read the manufacturer's manual carefully before use of any equipment		1.0	0.0	1.0
	PC19. unplug the electrical equipment before performing maintenance		1.0	0.4	0.6
	PC20. keep the floors free from oil, water and grease to avoid slippery surface		1.0	0.4	0.6



	Assessment criteria (PC)	Total Marks (400)	Out of	Theory	Skills Practical
	PC21. use rubber mats in the places where floors are constantly wet		1.0	0.0	1.0
	PC22. ensure safety from injuries of cuts to loss of fingers, while handling sharp hazardous tools and equipment		1.5	0.4	1.1
	PC23. use flat surfaces, secure holding and protective wear while using such sharp tools		1.5	0.4	1.1
	PC24. use health, safety and environmental protection practices for storing, cleaning, and maintaining tools, equipment, and supplies		1.5	0.4	1.1
	PC25. practice ergonomic lifting, bending, or moving equipment and supplies		1.5	0.4	1.1
	PC26. identify the requirement for maintaining environmental norms		1.0	0.4	0.6
	PC27. comply with the environmental safety norms while on work to prevent accidents and health hazards		1.0	0.4	0.6
	PC28. follow company policies and rules regarding use of hazardous materials to avoid health, safety and environmental impacts caused by them		1.0	0.4	0.6
	PC29. ensure the employees have access to first aid kit when needed		1.0	0.0	1.0
	PC30. ensure all equipment and tools are stored and maintained properly and safe to use		1.0	0.4	0.6
	PC31. ensure to use personal protective equipment and safety gear such as gloves, mask, headwear, footwear, glasses, goggles, etc. for specific tasks and work conditions where required		1.5	0.4	1.1
	PC32. display safety signs at places where necessary for people to be cautious		1.5	0.4	1.1
	PC33. ensure electrical precautions such as insulated clothing, adequate equipment insulation, dry work area, switch off the power supply when not required, etc.		1.5	0.4	1.1
	PC34. ensure availability of general health and safety equipment such as fire extinguishers, first aid equipment, safety equipment, clothing, safety installations such as fire exits, exhaust fans, etc.		1.5	0.4	1.1
	PC35. document all the first aid treatments, inspections, etc., conducted to keep track of the safety measures undertaken		1.0	0.4	0.6
	PC36. document all the environmental hazards caused and the measures undertaken to comply with the established safety procedures of the workplace		1.0	0.0	1.0

	Assessment criteria (PC)	Total Marks (400)	Out of	Theory	Skills Practical
	PC37. report to the supervisor on any problems and hazards identified and any breach of environmental procedures.		1.0	0.4	0.6
	PC38. ensure zero accident at workplace		1.0	0.4	0.6
	PC39. adhere to safety standards and ensure no material damage		1.0	0.4	0.6
	PC40. take necessary action and correct any environmental hazards caused		1.0	0.4	0.6
	<b>POINTS</b>		<b>50</b>	<b>14</b>	<b>36</b>
	<b>TOTAL POINTS</b>			<b>50</b>	

	Assessment criteria (PC)	Total Marks (400)	Out of	Theory	Skills Practical
<b>PCS/N9904 Maintain IPR of organisation and customer</b>	PC1. prevent leak of new plans and designs to competitors by reporting on time	<b>50</b>	7.0	0.0	7.0
	PC2. be aware of any of company's product or design patents		8.0	1.0	7.0
	PC3. report IPR violations observed in the market, to supervisor or company head		8.0	2.0	6.0
	PC4. read copyright clause of the material published on the internet and any other printed material		8.0	0.5	7.5
	PC5. protect infringement upon customer's business or design plans		8.0	2.0	6.0
	PC6. consult supervisor or senior management when in doubt about using information available from customer		6.0	0.0	6.0
	PC7. report any infringement observed by anyone in the company		5.0	0.0	5.0
	<b>POINTS</b>		<b>50</b>	<b>5.5</b>	<b>44.5</b>
	<b>TOTAL POINTS</b>			<b>50</b>	
	<b>GRAND TOTAL</b>	<b>400</b>			

Do



- Explain each Guideline for Assessment in detail
- Explain the score that each trainee needs to obtain
- Recapitulate each NOS one-by-one and take participants through the allocation of marks for Theory and Skills Practical.
- Explain the Allocation of Marks. Explain that they will be assessed on Theory and Skills Practical.
- Explain marks allotted for Theory and Skills Practical for each NOS

## Annexure III

### Powder Coating Glossary of Terms and Definitions

<b>Abrasive</b>	Coarse material used in grinding, polishing or cleaning hard surfaces such as sand, grit, steel shot, or glass or plastic beads.
<b>Acrylic Resin</b>	A clear resin derived from polymerization of acrylic acid and esters of various acrylic monomers. Acrylic resins have good outdoor durability and hence are widely used as automotive and appliance topcoats and in other applications where resistance to chalking with exposure to sunlight is important.
<b>Additives</b>	Chemicals added in small quantities, to a coating, to improve some property of the paint such as flow and levelling, gloss and distinctness of image, Etc.
<b>Adhesion</b>	Bonding strength. Molecular attraction to the surface to which a substance is applied. A condition where one material is attached to another by means of surface attraction. Adhesion is affected by the condition of the surface to be coated, by closeness of contact, and molecular forces. The surface being coated should allow a certain amount of penetration, be chemically clean, be hard, not too smooth, and non-porous, to achieve good adhesion.
<b>Agglomerate</b>	A clump of particles bound loosely together into clusters containing entrapped air. Agglomerates can be broken down to primary particle size by applying a mechanical force.
<b>Air Cap/Nozzle</b>	Perforated housing (at the head of a spray gun or nozzle) which directs compressed air against a coating material to form and shape it into an atomised cloud.
<b>Air Velocity</b>	Measurement of air speed, typically in feet per minute.
<b>Air Volume</b>	Measurement of air volume in cubic feet per minute.
<b>Alkali</b>	Is a basic, ionic salt of an alkali metal or an alkaline earth metal. It is a base that dissolves in water. The solution of the soluble base has a pH greater than 7 (Example: Sodium hydroxide or caustic soda, lye, caustic potash, etc.)
<b>Ambient</b>	Immediate surrounding environmental conditions.
<b>Anchor Pattern</b>	Profile of a surface. Usually refers to surface profile after blasting.
<b>Application</b>	Process of applying a coating to a substrate.
<b>Aqueous</b>	A water-based material.
<b>Arcing</b>	A discharge of built-up electrical charge, often in the form of a spark, to a point of lower charge, usually ground.
<b>ASTM</b>	The American Society for Testing Materials, the source for voluntary consensus standards for materials, products, systems, and services.
<b>Abrasion Resistance</b>	The resistance of a cured coating to physical damage from scratching, abrasives in cleaners or rubbing by contact with a hard object.
<b>Achromatic Colour</b>	A neutral colour with no hue.
<b>B-staging</b>	A process describing a powder coating material that has partially reacted or cured during manufacturing or storage.

<b>Back Ionization</b>	A condition which may occur during electrostatic application where an excessive build-up of charged particles limits further deposition on the substrate and can reverse the electrical charge of the surface layer of particles. May also be referred to as Electrostatic Rejection and/or Repelling.
<b>Blast Cleaning</b>	Removal of surface contaminant from a part by use of an air- or mechanically-propelled abrasive.
<b>Blistering</b>	Bubbles formed under a cured powder film, usually caused by the expansion of trapped air, moisture, or corrosion, either in a coating or in the substrate.
<b>Blocked Isocyanate</b>	A curing agent for hydroxyl-containing resins. Releases the blocked curing agent upon reaching the de-blocking temperature, usually an elevated temperature.
<b>Bonding</b>	Adhesion or secure joining of coating-to-coating or coating-to-substrate.
<b>BTU</b>	British Thermal Unit, the quantity of heat required to raise the temperature of 1 pound of water, by 1 degree F, at a surrounding temperature of 39.2 degrees F.
<b>BTUH</b>	BTU's times hours.
<b>Cartridge Booth</b>	A type of powder booth that incorporates a cartridge filter system for powder overspray recovery.
<b>Cartridge Collector</b>	A self-contained unit with a cartridge filter housing or box for recovery of over sprayed powder that is used with a powder booth.
<b>Catalyst</b>	A chemical substance that increases the rate of a reaction, without itself undergoing any permanent chemical change. In case of coatings, the catalyst promotes the curing/ crosslinking reaction.
<b>Cleaner</b>	Detergent, alkali, acid, solvent, or any other cleaning material, often water- or steam-borne, used to clean and degrease parts prior to application of coatings.
<b>Clear Coat</b>	An unpigmented, transparent coating applied over a colour or base metal.
<b>Channeling</b>	Holes formed in the surface of the bulk powder as it is being withdrawn from below in the hopper.
<b>Chemical resistance</b>	Tendency of a film to resist degradation upon exposure to various chemicals. .
<b>Chromaticity</b>	Two-dimensional colour specification, not involving illuminance, illustrated by pairs of numbers for dominant wavelength reflectance and purity.
<b>Coalescent Filter</b>	A filter used in the compressed air line to fuse and trap liquid particles in the air stream.
<b>Colour Chip</b>	Small piece of paper, celluloid, or other material, coated with finishing material and used as a colour finish sample.
<b>Compliance Coating</b>	Coating which meets EPA defined standards for air, water, and waste disposal regulations.
<b>Conversion Coating</b>	Inorganic (zinc/iron phosphate) chemical pretreatment for metal substrates that prepares the surface for coating.
<b>Corona</b>	A glowing, bluish or reddish area created by a discharge of electricity.
<b>Corona Charging</b>	The process of inducing a static electric charge on powder particles by passing the powder through an electrostatic field generated by a high voltage device.
<b>Corrosion</b>	Decomposition or reaction of metal with oxygen, water, or other chemicals, when exposed to a particular environment. E.g. Iron

<b>Counter flow</b>	Transporting overflowed solution from one washer stage to another for reuse.
<b>Crater</b>	Small round depressions on a paint film, where the basecoat or base metal is not exposed
<b>Creepage</b>	Corrosion spread under a damaged coating film when exposed to corrosive service conditions.
<b>Cross Contamination</b>	A condition when two or more powders are mixed by accident, usually resulting in a reduction in quality.
<b>Cure</b>	the polymerization of the resins and cross linkers in the binder system to the desired molecular weight and physical properties of the coating, converting from a dry state to a solid continuous film.
<b>Cyclone</b>	A cylindrical device that separates powder particles from the air stream by centrifugally spinning the particles around its perimeter to the bottom for recovery. Some of the finer particles pass through the cyclone to a collector.
<b>Decorative Coating</b>	A coating designed primarily for cosmetic/ aesthetic appearance with little or no protection properties. Decorative coatings are usually thin films (>5 mils).
<b>Deflector</b>	Conical shaped disc attached to the end of a powder gun to evenly distribute powder in a 360-degree pattern. Used to shape or direct the powder pattern.
<b>Deionised Water</b>	Water containing no ions other than hydrogen and hydroxyl ions. Usually produced through the use of ion exchange resins and used for rinsing parts after a seal rinse in a spray washer.
<b>Delamination</b>	Separation between two layers of coating or the coating and the substrate.
<b>Delivery</b>	The process of moving the coating material through the application equipment to the end product.
<b>Discolouration</b>	Colour change.
<b>DOI</b>	Distinctness of Image. A test used to describe the surface reflectance of a paint film. A mirror would have very high DOI, but a low gloss texture would have no DOI.
<b>Down-draft Booth</b>	A coating booth in which the extraction opening is at the bottom of the booth.
<b>Drag-out</b>	Process of solution entrapment being pulled with the product typically out of a washer zone or coating enclosure.
<b>Dry Film Thickness</b>	The thickness of the coating film deposited on the substrate after curing/ drying. Generally measured in microns.
<b>Edge Coverage</b>	A coating's ability to flow over, build, and adhere to sharp corners, angles and edges.
<b>Electrode</b>	A metal filament within or at the end of an electrostatic equipment, used to create charged coating particles as high voltage is applied.
<b>Electrostatic Spray Technique</b>	A process of spraying charged coating particles to coat a substrate more efficiently. The coating material, in the form of powdered particles or atomised liquid, is projected towards a conductive work piece, by a powerful electrostatic charge
<b>Environmental Protection Agency (EPA)</b>	Agency of the U.S. Government whose purpose is to regulate and control those agents affecting the environment.
<b>Epoxy Resin</b>	Are a class of prepolymers and polymers which contain the epoxide groups.
<b>Etching</b>	Surface preparation of metal by chemical process. Removal of a layer of the base metal.

<b>Extruder</b>	Device used to melt-mix plastics and/or coating powders. An extruder utilises heat and mechanical kneading to achieve a homogeneous mixture.
<b>Fading</b>	Gradual loss of colour of a paint film due to a chemical or physical change, usually caused by exposure to light.
<b>Fan Pattern</b>	Geometry or shape of spray pattern.
<b>Fan Spray Nozzle</b>	provide a fan-shaped spray pattern.
<b>Faraday Cage Effect</b>	A condition where the recessed areas/ inside of a box section of a substrate, due to its geometric configuration, may not receive any coating, in electrostatic application.
<b>Fatty Edge</b>	Thick film found along the edges.
<b>Feed Hopper</b>	A container that holds powder for supply to the guns. Most feed hopper designs employ fluidisation of the powder for uniform feed to the guns. See Fluidised Bed.
<b>Ferrous</b>	Containing iron.
<b>Filler</b>	Extender, bulking agent or inert pigment.
<b>Film Build</b>	thickness of the coating after curing.
<b>Fines</b>	Small powder particles, usually under 10 microns.
<b>Fisheye</b>	A large surface depression in a coating film often caused by a contaminant such as oil or silicone.
<b>Flash Rusting</b>	rust formation on a clean metal surface within minutes of cleaning during the pre-treatment process
<b>Flow</b>	Measure of self-levelling. Characteristics of a coating allowing it to level or spread into a smooth film of uniform thickness before hardening.
<b>Fluidise</b>	A term that describes powder that is in a state of suspension using compressed air, creating a fluid mixture of air and powder.
<b>Fluidised Bed</b>	A fixed container in which powder is suspended in a continuous stream of air. Preheated objects may be coated by dipping directly into a fluidised bed. The fluidised bed may also be used to facilitate transfer of powder materials to an alternate application site.
<b>FPM</b>	Feet Per Minute, a measure of air flow speed.
<b>Galvanised Steel</b>	Steel coated with a layer of metallic zinc.
<b>Gassing</b>	Air or gas that escapes from a sub-surface beneath a coating and causes blisters, bubbles or small holes in the coating. Gassing frequently occurs with zinc or aluminium castings or galvanised steel and is commonly referred to as out-gassing.
<b>Gauge</b>	Instrument or device for measuring, indicating or comparing a physical characteristic.
<b>Gel Time</b>	Interval required at a given temperature for a powder to be transformed from a dry solid to a gel-like state. Gel time is measured in seconds at a given temperature.
<b>Geysers</b>	Spouts of air and powder found in a fluid hopper when uneven air dispersion is applied.

<b>Gloss</b>	<p>Is the measurement of the light reflected by the coated surface. Light incident on the coated surface is partially absorbed by the surface and partially reflected. The reflected light is measured and reported as gloss value. The reflected light is measured at different angles for different levels of gloss.</p> <p>An angle of 20 degree is used for full gloss surfaces.</p> <p>An angle of 85 degree is used for matt surfaces.</p>
<b>Gloss Retention</b>	Ability to retain the original gloss.
<b>GPM</b>	Gallons Per Minute.
<b>Grounding</b>	Earthing of the component or substrate.
<b>Gun Extension</b>	Extension adapter to a spray gun. Allows for better penetration for manual reinforcement.
<b>Hardener</b>	Curing/ Crosslinking agent for thermoset coatings.
<b>Hardness</b>	The ability of a cured coating to withstand indentation.
<b>HEPA Filter</b>	High efficiency particulate air-purifying filter. Separates particles down to sub-micron sizes from air.
<b>Hexavalent Chrome</b>	Chromium with +6 valency.
<b>Hiding Power</b>	The extent to which a coating masks the colour and pattern of the surface it is applied to at a given film thickness.
<b>HVAC</b>	Heating, Ventilating, Air Conditioning air supply system.
<b>Hybrid</b>	An epoxy-modified polyester or an epoxy-modified acrylic thermoset coating powder. Hybrids usually have good overbake and good application properties.
<b>Hygroscopic</b>	The tendency of a substance to attract or absorb moisture from the air.
<b>Impact Fusion</b>	The tendency of finely divided powders to combine with other particles in the application equipment during the application process.
<b>Infrared Radiation</b>	Electromagnetic energy in the infrared region of the electromagnetic spectrum.
<b>Integral Charging</b>	A powder gun that has a low voltage signal supplied to it and steps up the current to high voltage via a cascade multiplier located in the gun barrel.
<b>Intercoat Adhesion</b>	A coating's ability to adhere to previously applied films.
<b>Iron Phosphate</b>	Conversion coating. Chemical deposition on steel and aluminium for corrosion protection.
<b>Isocyanate Resins</b>	Resins containing NCO group (isocyanate). These act as cross linking agents and react with hydroxyl functional polymers, give urethane coatings.
<b>Lance Extension</b>	Variable extensions for powder guns.
<b>Lower Explosive Limit (LEL)</b>	The lower point for a range of concentrations of organic particles suspended in air which can be ignited by a sufficient energy source. Also, referred to MEC or Minimum Explosive Concentration.
<b>Magnehelic Gauge</b>	Trade name of Dwyer Instruments' gauge for measuring air pressure in inches or water column.
<b>Mandrel Bend Test</b>	Physical bending test for testing flexibility. (ASTM Test D522)



<b>Masking</b>	Covering areas of a part to prevent coverage by coating during application.
<b>Material Safety Data Sheet (MSDS)</b>	Information supplied by manufacturers listing all known hazardous ingredients, physical and health hazards, first-aid procedures and safe material handling procedure with the use of personal protective equipment.
<b>Material Utilisation</b>	The percentage of a volume of coating that is deposited on the parts, not lost through handling, transfer onto the racks, contamination or as non-reclaimed material.
<b>Matte</b>	A surface with minimal reflection of light, the opposite of high gloss.
<b>Melt Mixing</b>	A predominant process for the manufacture of coating powders involving the continuous compounding of the pigments, fillers, catalysts and resins at elevated temperatures.
<b>Mil</b>	A measurement of film thickness, 1 mil = .001' = 25 Microns
<b>Mild Steel</b>	Structural steel or plate, malleable iron based alloy. SAE 1020, with a carbon content of up to 2.5%.
<b>Mileage</b>	Term used to describe the amount of area that can be covered with a given amount of coating material. Measured in ft <sup>2</sup> /lb, ft <sup>2</sup> /Kg, ft <sup>2</sup> /Litre or m <sup>2</sup> / L
<b>Mill Scale</b>	Oxide layer formed on steel by hot rolling process.
<b>Molten Salt</b>	Inorganic chemical or chemicals that are used at temperatures above their melting point as heat transfer, heat treating or metal cleaning purposes.
<b>Molten Salt Bath</b>	A specially designed vessel used to contain and heat molten salt processes.
<b>Non-Ferrous</b>	A material containing no iron.
<b>Nylon</b>	A synthetic polymer, containing aliphatic polyamides.
<b>OEM</b>	Original Equipment Manufacturer.
<b>Off-colour</b>	Not matching the colour standard
<b>Ohm</b>	A unit of electrical resistance.
<b>Opacity</b>	Ability to hide the substrate at a given film thickness.
<b>Orange Peel</b>	A wavy irregularity in the surface of a coated film resembling the surface of an orange peel. This is caused by the poor flow characteristics of the coating.
<b>Organic</b>	Substance containing carbon compounds.
<b>Oscillator</b>	Device used to move automatic guns in a vertical plane to provide uniform and increased coverage. Motion is provided by a wheel and arm mechanical device within the unit. Radial oscillators, or wagglers, move the guns in an arc motion.
<b>OSHA</b>	Occupational Safety and Health Administration; government enforcement agency for safety issues in U.S. industry.
<b>Overall Efficiency</b>	The product of the compression efficiency and the mechanical efficiency.
<b>Over atomised</b>	Powder that has been dispersed too finely but by use of excessive atomising air pressure.
<b>Overbake</b>	Applying more heat in time and/or temperature than is required for cure. Overbake is the result of curing paint film at too high of a combination of time and temperature. The film often becomes too hard and may embrittle and/or colour and gloss may be adversely affected.
<b>Overspray</b>	Material that does not deposit on the component and goes to the recovery system.



<b>Part Bring-up Time</b>	Amount of time required to heat a part to a desired metal temperature.
<b>Part Opening</b>	The opening in the powder booth, ovens, washers and other equipment where parts enter and exit.
<b>Particle Size</b>	The average diameter of an object having irregular boundaries that can be determined to have diameter through various test methods.
<b>Passivation</b>	Conversion of a metal surface to a less reactive state. A process used to reduce the corrosion rate of metal surfaces.
<b>pH Value</b>	Measure of acidity or alkalinity. pH7 is neutral. The pH values of acids are less than 7. The pH values of alkali bases are greater than 7.
<b>Phosphate</b>	Chemical radical (PO <sub>4</sub> )-3. In coating operations, zinc, iron or manganese phosphate is used as a conversion coating to prepare the part for coating application.
<b>Pigment</b>	Insoluble powder chemicals that provide colour, corrosion resistance and other properties to a coating.
<b>Pinholing</b>	Formation of small holes through the entire thickness of a coating. The appearance of fine, pimply defects in a cured film, due to air trapped under the surface of the film or other causes, resulting in small holes in the film.
<b>Plenum</b>	Air chamber used to transition or distribute airflow within a powder spray booth.
<b>Polyester</b>	A resin or powder containing the chemical group R-COOC-R.
<b>Polyethylene</b>	A thermoplastic resin with the formula (CH <sub>2</sub> CH <sub>2</sub> ) x.
<b>Polymers</b>	Poly means many and mer means units. Polymers are very large molecules built up by the combination of many small molecules, often having many thousands of atoms.
<b>Polymerization</b>	Chemical reaction in which small molecules combine to form very high molecular weight molecules.
<b>Polypropylene</b>	One of the more common polyolefin thermoplastics. An addition polymer from propylene monomers with a crystalline structure (CH <sub>2</sub> CHCH <sub>2</sub> ) x.
<b>Polyvinyl Chloride</b>	Synthetic resin used in solvent-type coatings; produced by polymerization of vinyl chloride. Also, used in vinyl powders.
<b>Porosity</b>	Degree of integrity or continuity.
<b>Post-curing</b>	Heating of a part after powder coating to complete the cure cycle, which completes the cross linking of the components.
<b>Power &amp; Free Conveyor</b>	Two-track chain conveyor system that allows product to be transported at different speeds and through different routes throughout the finishing system.
<b>Powder</b>	A coating blend made of non-volatile ingredients, applied dry and melted into a continuous film.
<b>Powder Booth</b>	An enclosure used for containment of powder during the spray operation.
<b>Powder Coating</b>	Coatings that are protective, decorative, or both, formed by the application of a coating powder to a substrate and fused into continuous films by the application of heat or radiant energy. Coating powders are finely divided particles or organic polymer which generally contain pigments, fillers and additives; and which remain finely divided during storage under suitable conditions.
<b>Powder Room</b>	A room that isolates the powder application process from the general plant environment. Sometimes referred to as Environmental Room.

<b>Pressure</b>	Force per unit area relative to atmospheric pressure. Usually expressed in pounds per square inch.
<b>Pre-treatment</b>	The preparation of a part prior to the application of a coating in order to improve adhesion and corrosion resistance.
<b>Primer</b>	A type of coating, usually paint, applied to a surface, improves the adhesion of the paint film to the substrate and provides an anchor to the top coat.
<b>Primer Surfacer</b>	A coating applied after the primer and before the topcoat. Provides a smooth levelled surface for the topcoat.
<b>Production Rate</b>	A measure of production per hour/shift/day in terms of number of components coated/ number of units produced.
<b>Profile</b>	Surface contour of a blast-cleaned surface as viewed from the edge cross-section of surface.
<b>Profile Depth</b>	Average distance between top of peaks and bottom of valleys on a surface.
<b>PSI</b>	Pounds per square inch, a measure of force above a vacuum.
<b>Pump</b>	Device which converts mechanical force and motion into hydraulic fluid powder.
<b>Pump Screen</b>	A screen that catches large contaminants in a process solution as the solution flows through it to the pump.
<b>Purging</b>	Cleaning one colour or coating formulation from all areas that come in contact with the colour or coating before introducing another colour or coating.
<b>Radiation Cure</b>	Curing a coating by means of exposure to electromagnetic waves or particles such as infrared, ultraviolet or electron beam.
<b>Reciprocator</b>	Device used to move automatic guns in a vertical plane. Motion is provided by a reversing or reciprocating drive system.
<b>Reclaim</b>	The process used to recycle nondeposited coating through the delivery system for reuse.
<b>Reclaimed Powder</b>	Powder which has been over sprayed and captured for reuse.
<b>Recoat</b>	Process of refinishing parts that have a surface defect from the first coating application by repairing the defect and respraying.
<b>Recovery</b>	The process of removing nondeposited powder from the air prior to recirculating the powder through the delivery system.
<b>Recovery System</b>	A filtration system that separates powder from the airstrip with a fan that captures over sprayed powder and maintains negative air pressure inside a powder booth. Most common type of recovery systems are the cyclone system and the cartridge module system.
<b>Resin</b>	Any class of solid or semi-solid organic material of natural or synthetic origin, generally of high molecular weight with no definite melting point. Most resins are polymers.
<b>Resistivity</b>	The resistance to the flow of electrical current afforded by a substance.
<b>Reverse Osmosis</b>	Method of removing metal ions from an aqueous solution via semi-permeable membranes.
<b>Rework</b>	Procedures to correct coating imperfections or defects.
<b>Runs</b>	Sags in the coating.

<b>Rust</b>	Corroded iron. Red iron oxide deposited on metal. Also, other metal oxides formed by corrosion.
<b>Salt Spray Test</b>	Corrosion test using salt (NaCl) solution sprayed as a mist in a heated humidity chamber to simulate seashore conditions, or to accelerate corrosion at a controlled rate. (ASTM Test B117)
<b>Sand Blast</b>	Blast cleaning using sand as an abrasive.
<b>Sanitary Pan</b>	A trough that is mounted under a conveyor chain to catch debris and keep it from falling on work in progress.
<b>Scale</b>	Rust occurring in layers, commonly found on hot-rolled steel.
<b>Screen Mesh Size</b>	The mesh number of a screen designates the openings per square inch using standard wire. Screens are used to classify the size of the coating powders.
<b>Seal Rinse</b>	A final rinse in a spray washer that passivates the pre-treated surface to prevent oxidation and provide corrosion resistance in the field.
<b>Seeding</b>	Formation of small agglomerates or gel particles. Seeds in coating powders can form when the material is overheated during the extrusion process.
<b>Shelf Life</b>	Maximum amount of time a material may be stored and still be in usable condition.
<b>Shot Blasting</b>	Blast cleaning using steel shot as the abrasive.
<b>Side-draft Booth</b>	A powder booth where the air extraction opening is on the side of the booth.
<b>Sieve</b>	Powder particle classifier which utilises wire mesh of various sizes to screen out oversized powder particulate and foreign material or dirt.
<b>Rotary Sieve</b>	Cylindrical screen equipped with an electrically driven paddle used to classify powders, or remove undesirable particulate from powder materials.
<b>Vibratory Sieve</b>	Electrically or pneumatically driven screen utilising vibration to classify powders, or remove undesirable particulate from the powder materials.
<b>Silicone</b>	One of a family of polymeric materials in which the recurring chemical group contains silicone and oxygen atoms as links in the main chain. These compounds are derived from silica, i.e., sand, and methyl chloride. The various forms obtainable are characterized by their resistance to heat. Uses for silicone include: greases for lubrication; rubber-like sheeting for gaskets; heat-stable fluids; compounds for waterproofing and insulation; thermosetting insulation varnishes; and resins for both coating and lamination. [Silicone lubricants should not be used around a finishing system because it will cause defects in the finished surface.]
<b>Sintering</b>	The tendency of some powders and powder coating materials to agglomerate during storage.
<b>Soils</b>	Foreign matter on a part's substrate prior to being cleaned in a pre-treatment system. Can be organic or inorganic.
<b>Solvent</b>	Liquid or blend of liquids used to dissolve or disperse a paint. A true solvent is a single liquid which can dissolve a paint.
<b>Solvent-borne Coating</b>	Coating containing only organic solvents. (Non-water-borne)

<b>Specific Gravity</b>	An expression of density of a material relative to water. Examples: water - 1.000; ammonia - .587; propane - 1.550; natural gas - .665. Ratio of the weight of a given volume of liquid or solid to the weight of an equal volume of water. (ASTM Test D3451)
<b>Specular Gloss</b>	Mirror-like reflectance. Gloss measured at a specific specular angle. (ASTM Test D523)
<b>Spray Pattern</b>	Configuration of spray with a gun. See Diffuser and Fan Spray Nozzle.
<b>Spray-to-waste Operation</b>	Utilising virgin powder only. All overspray powder is discarded and not recycled.
<b>Storage Life</b>	Period of time that a material will remain usable in storage.
<b>Storage Stability</b>	The ability of coating material to maintain uniform physical and chemical properties after being subjected to the manufacturer's specified storage conditions.
<b>Substrate</b>	The part to be coated.
<b>Surface Defects</b>	Flaws/ defects in the surface of a coated part.
<b>Surface Preparation</b>	Operations necessary to prepare the surface of a part prior to the application of a coating.
<b>Surfactant</b>	Chemical used to adjust surface tension of a material.
<b>Surge</b>	(1) A rise of pressure in an electrical circuit. (2) A sudden burst of powder from the spray gun.
<b>Take up</b>	A device that maintains tension on a conveyor chain during operation.
<b>Tape Adhesion</b>	Test used to check for adhesion of a coating to a surface. (ASTM Test D3359)
<b>TDS</b>	Total dissolved solids, a measurement of the solids content of water in parts per million (ppm).
<b>Technical Data Sheet (TDS)</b>	A document provided by a supplier that details the properties and expected performance of a material. Also, known as Product Data Sheet.
<b>Telegraphing</b>	Phenomenon that occurs when a surface defect on an uncoated part is visible through the cured film after the coating is applied.
<b>TGIC</b>	Triglycidyl Isocyanurate, a common crosslinker for carboxyl polyester resins.
<b>Theoretical Coverage</b>	The capacity of a given mass of a specific powder to coat, in a cured state, an area of substrate at a determined film thickness.
<b>Thermocouple</b>	A pair of dissimilar metal wires that generate an electric force at the point of connection which varies in proportion to temperature.
<b>Thermoplastic</b>	A powder coating which will repeatedly melt when subjected to heat and solidify when cooled. Typical examples are vinyls (PVC), nylons, and polyolefins.
<b>Thermosetting</b>	Powder coating chemistry that undergoes an irreversible chemical change during thermal cure. Examples are: epoxy, polyurethane, acrylic.
<b>Threshold Limit Value (TLV)</b>	The concentration of a compound that a worker can be exposed to day-to-day without experiencing any adverse effects. TLV's are established by the ACGIH.
<b>Throughput</b>	The production output of a system at a given line speed using a predetermined part density or hang pattern.

<b>Time Weighted Average (TWA)</b>	The legal limit of exposure of a chemical measured as average exposure over an eight-hour period of time. TWA's are established by OSHA and are used to define Permissible Exposure Levels (PEL).
<b>TLV</b>	See Threshold Limit Value.
<b>Tooth</b>	Profile. Mechanical anchorage. Surface roughness.
<b>Totes</b>	Large containers for shipping bulk powder coatings.
<b>Toxic</b>	Poisonous.
<b>Toxicity</b>	Degree of poisonousness or harmfulness.
<b>Transfer Efficiency</b>	The ratio of the powder deposited compared to the amount directed at the part to be coated.
<b>Transformer, Pneumatic</b>	Device used for regulation of pressure in, and removal of moisture from, an air supply line.
<b>Tribocharging</b>	A method to impart electrostatic charge on a powder coating by the friction or contact of the powder with a material of dissimilar dielectric constant.
<b>Triglycidyl Isocyanurate (TGIC)</b>	A tri- functional epoxide compound that is commonly used as a crosslinker for carboxyl polyester resins.
<b>Triggering</b>	Intermittent squeezing and releasing of a spray gun trigger, or turning them on and off intermittently for some systems.
<b>Turbulent Flow</b>	Air currents within a spray booth that may be strong enough to negatively affect the application of powder. Good transfer efficiency is dependent on laminar air flow.
<b>TWA</b>	See Time Weighted Average.
<b>Two-stage Compressors</b>	Compressors in which compression from initial to final pressure is completed in two distinct steps or stages.
<b>Ultraviolet Absorber (UVA)</b>	A chemical that absorbs harmful UV energy and dissipates it into heat energy. UVA's are used to reduce coating degradation due to exposure to solar energy.
<b>Ultraviolet Radiation</b>	Light energy having a wave length of about 0.4 to 80 milimicrons. Such energy can break certain chemical bonds and contribute to the fading and wearing away of coatings.
<b>Underatomised</b>	Not enough atomising air in ratio to supply air, resulting in a spray pattern that surges and is not fine enough for good charging efficiency.
<b>Undercured</b>	A coating that has not had enough exposure to the combination of heat and time to completely cure.
<b>Upper Explosive Limit</b>	Concentration of solvent vapor or coating powder particles in air above which the mixture will not explode if ignited.
<b>UV Flame Detection System</b>	A device that senses the UV light emission cause by an ignition source. In powder coating application systems, these devices are used to shut down the spray process when a spark is detected.
<b>UV Flame Detection System</b>	A device that senses UV light in a powder booth and shut the equipment off when it detects a spark.
<b>Vacuum Wand</b>	Vacuum cleaner or wand for twin air belt booth or a tool used with a vacuum system for cleaning up powder.

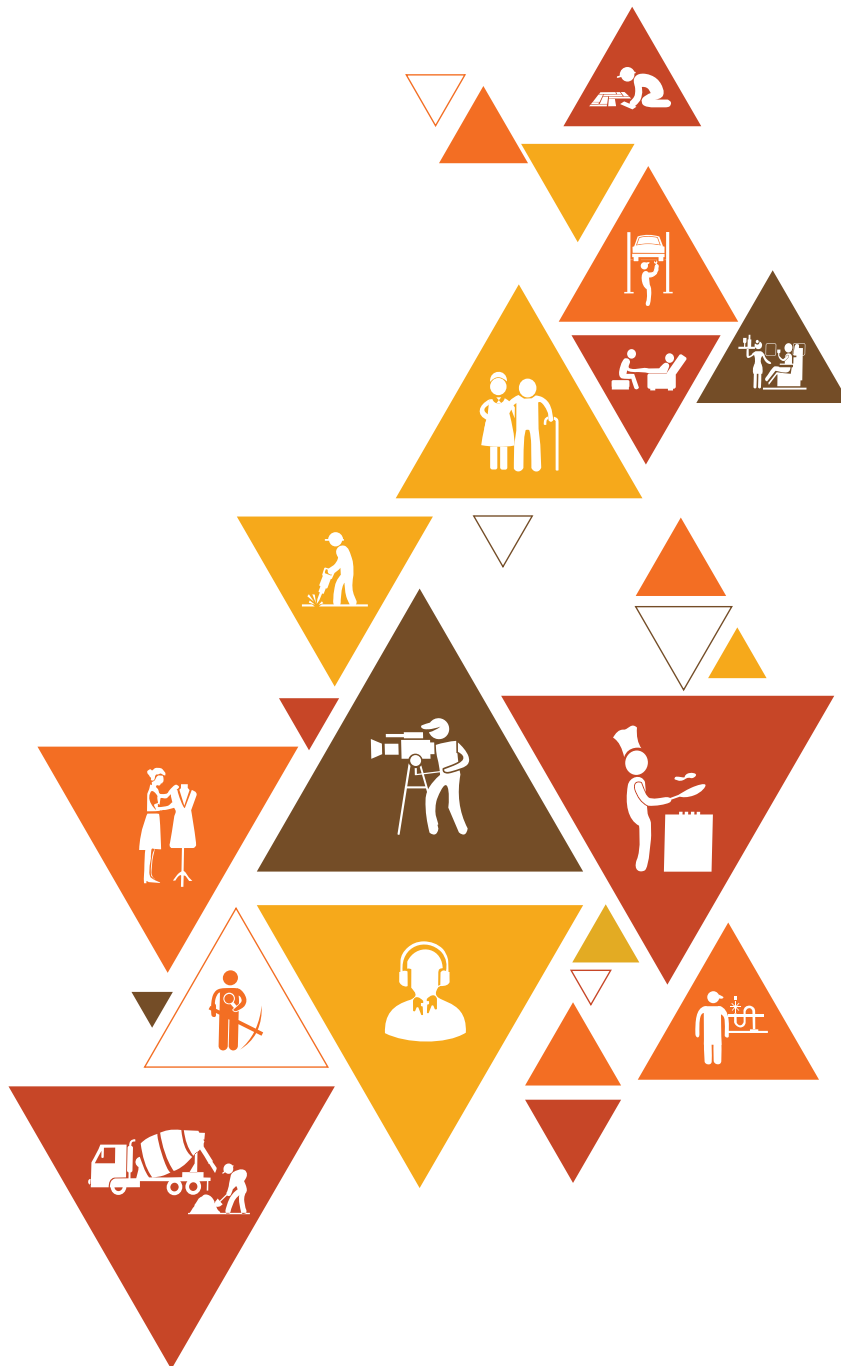
<b>Valve, Check</b>	Direction control valve that allows air to pass in only one direction.
<b>Valve, Flow Control</b>	Valve whose primary function is to control flow rate.
<b>Valve, shut-off</b>	Valve that operates fully open or fully closed.
<b>Valve, Throttling</b>	Valve used to regulate the pressure/flow of solutions in the washer.
<b>Velometer</b>	Device to measure the speed of air in feet per minute.
<b>Venturi</b>	A constricted throat in a powder pump that uses compressed air to lift and transport powder from the feed hopper to the application equipment device, from the bulk feeder to the feed hopper, from the cartridge module to the feed hopper, etc.
<b>Vertical Zoning</b>	Triggering only the guns needed to coat a given part length to reduce overspray when a conveyor is loaded with parts of various lengths. Multiple photo-eye inputs can be used to control which guns are used on any given part.
<b>Vestibule</b>	Small entrance hall to pre-treatment washer, powder booth, or oven.
<b>Vibratory Box Feeder</b>	A device allowing the powder to be pumped directly from the box container utilising vibration to keep powder moving.
<b>Vibratory Sieve</b>	See Sieve, Vibratory.
<b>Vinyl</b>	A popular name for thermoplastic polyvinylchloride (PVC) materials.
<b>Vinyl Coating</b>	A coating in which the major portion of the binder is a vinyl resin.
<b>Vinyl Copolymer</b>	Resins produced by copolymerizing vinyl monomers such as vinyl acetate and vinyl chloride.
<b>Vinyl Resin</b>	Synthetic resins made from vinyl compounds.
<b>Virgin Powder</b>	Unsprayed powder as opposed to sprayed or reclaimed powder.
<b>VOC</b>	See Volatile Organic Compound.
<b>Volatile Content</b>	The quantity, expressed as a weight percent of the powder, which is lost under specified conditions of temperature and time.
<b>Volatile Organic Compound (VOC)</b>	Hydrocarbon chemicals that can evaporate into the atmosphere and are recognised by the US EPA as contributors to photochemical smog. VOC's are commonly emitted from solvent borne paints.
<b>Voltage Tester</b>	Instrument used to measure voltage output at the corona tip of an electrostatic powder spray gun.
<b>Voltmeter</b>	Instrument used to measure potential differences in volts.
<b>Volume Resistivity</b>	Resistance in ohms per unit of volume. The property of a material that determines its resistance to the flow of an electrical current.
<b>Volumetric Efficiency</b>	The ratio of the actual capacity of the compressor to displacement, expressed in percent.
<b>W Pattern Calculation</b>	Calculation of the coverage for combined motions of part travel and gun oscillation.
<b>Waggler</b>	See Oscillator.
<b>Washer Drain Zone</b>	The space in between spray zones within the washer tunnel.

<b>Washer Process Zone</b>	The spray treatment zone within the washer tunnel.
<b>Washer Vestibule</b>	The portion of the washer tunnel at the entrance and exit.
<b>Water Spotting</b>	Whitish blemishes on a pre-treated part where minerals in the water have left a deposit on the surface.
<b>Weathering Resistance</b>	Also, Weatherability. The ability of a surface to withstand the outdoor elements without degradation.
<b>Weld Splatter</b>	Beads of metal left adjoining a weld.
<b>W.C.</b>	A measurement of pressure in inches of water column. The pressure to be measured is introduced into one end of a u-shaped tube filled with coloured water and the measurement is determined by how far up a tube the water is pushed.
<b>White Blast</b>	Blast cleaning to white metal surface.
<b>Wrap</b>	A characteristic of powder coatings in electrostatic application to seek out and adhere to areas of the substrate not in direct line of sight of the delivery system end point.
<b>Yellowing</b>	Development of yellow colour or cast in a light-coloured powder formulation due to aging or improper cure cycle.
<b>Zinc Phosphate Coating</b>	Conversion coating used on steel and galvanised steel parts to improve coating adhesion and corrosion resistance.

## Notes

[illegible]







**Skill India**

कौशल भारत - कुशल भारत



## PAINTS AND COATINGS SKILL COUNCIL



**Address:** 105, Kakad Chambers,  
132, Dr. Annie Besant Road, Worli, Mumbai 400 018.

**Email:** info@pcsc.in

**Web:** www.pcsc.in

**Phone:** +91-22-24931790

**CIN No.:** U74999MH2015NPL268985

**Price: ₹**



978-1-111-22222-45-7