

OBJECTIVE SYLLABUS FOR POWDER COATING MODULE

SECTION A - WHY SURFACE FINISHING?

Lesson 1 - Surface Finishing Techniques and Applications

At the end of Lesson 1 you should be able to:

- 1.1 Define surface finishing.
- 1.2 Describe the main processes used for Surface Finishing and their basic principles.
- 1.3 Describe the purposes for which these finishes are applied to substrates.
- 1.4 Describe the nature of the Surface Finishing Industry and its economic importance.

Lesson 2 - Properties of Different Surface Finishes

At the end of Lesson 2 you should be able to:

- 2.1 List the strengths and weaknesses of various surface finishes.
- 2.2 Decide which finish is appropriate for a particular function.

SECTION B - INTRODUCTION TO CORROSION

Lesson 3 - How Coatings Can Prevent Corrosion

At the end of lesson 3 you should be able to:

- 3.1 Define corrosion and understand its consequences.
- 3.2 Understand the chemistry of corrosion of iron.
- 3.3 Understand the electrochemical nature of the aqueous corrosion of metals.
- 3.4 Know how the electrochemical series can be used to select coatings for the prevention of corrosion.
- 3.5 Understand how coatings prevent corrosion.
- 3.6 Describe the need for accelerated corrosion tests for coated products and explain the main tests.

SECTION C - BASIC SCIENCE FOR COATINGS

Lesson 4 - Chemical Symbols and Chemical Equations

At the end of Lesson 4 you should be able to:

- 4.1 Write the chemical symbols for the chemicals used most often in surface finishing.
- 4.2 Write chemical equations for simple chemical reactions.

4.3 Understand how atoms join together by ionic and covalent bonds.

Lesson 5 - Calculating thicknesses, areas and volumes

At the end of Lesson 5 you should be able to:

- 5.1 Calculate area and volumes.
- 5.2 Calculate the coverage of paint and coating powders.
- 5.3 Calculate the cost of the paint or coating powder per component.

SECTION D- INTRODUCTION TO POWDER COATING

Lesson 6 - Types of Powder

At the end of Lesson 6 you should be able to:

- 6.1 Define powder coating.
- 6.2 List the most important advantages and applications of powder coatings.
- 6.3 Outline the chemistry of formation of a simple polymer such as polyethylene.
- 6.4 Outline bonding mechanisms between polymer chains.
- 6.5 Distinguish between thermosetting and thermoplastic polymers.
- 6.6 Explain the term copolymer.
- 6.7 Explain why it is important to store coating powders in cool, dry conditions.
- 6.8 Compare the properties of various powders.

SECTION E - CLEANING AND PRETREATMENT

Lesson 7 - Substrates and Their Cleaning

At the end of Lesson 7 you should be able to:

- 7.1 Understand why cleaning of the substrate is important.
- 7.2 Discuss the advantages and disadvantages of using solvents for cleaning.
- 7.3 Discuss methods of using water based systems for cleaning surfaces.
- 7.4 Discuss mechanical methods of cleaning.

Lesson 8 - Pretreatment with Chemical Conversion Coatings

At the end of Lesson 8 you should be able to:

- 8.1 Define the purposes of conversion coatings.
- 8.2 Discuss the chemistry of phosphating of steel.
- 8.3 Discuss the different types of phosphate coatings, explain their uses and be able to select the right one for products under different environmental conditions of use.
- 8.4 Describe the layout of a typical phosphating plant.
- 8.5 Discuss the use of chromate conversion coatings on different metals.

- 8.6 Know that safer alternatives to phosphating and chromating solutions are now available

Lesson 9 - Adhesion

At the end of Lesson 9 you should be able to:

- 9.1 Discuss some basic theories of adhesion that apply to powder coatings.
9.2 Discuss some of the problems which occur at a substrate/coating interface.
9.3 Assess the effectiveness of different cleaning treatments.

SECTION F - APPLICATION METHODS

Lesson 10 - Fluidised Bed Techniques and Flock Spraying

At the end of Lesson 10 you should be able to:

- 10.1 Know the factors that influence process selection.
10.2 Describe the fluidised bed technique.
10.3 Discuss the advantages and disadvantages of the fluidised bed technique.
10.4 Know when to use the fluidised bed technique.
10.5 Understand how electrostatic techniques can be used with the fluidised bed technique.
10.6 Describe the flock spraying process.
10.7 Know the advantages of flock spraying.

Lesson 11 - Principles of Electrostatic Spraying of Powders

At the end of Lesson 11 you should be able to:

- 11.1 Discuss the advantages and disadvantages of electrostatic powder spraying.
11.2 Know how electrostatic forces affect a particle during powder application.
11.3 Understand the principles of corona charging.
11.4 Understand the principles of tribo charging.
11.5 Compare corona and tribo charging methods.
11.6 Compare electrostatic spraying and fluidised bed processes for the application of powder coatings.

SECTION G - PLANT AND EQUIPMENT

Lesson 12 - Electrostatic Application Equipment

At the end of Lesson 12 you should be able to:

- 12.1 Describe the elements of the electrostatic application process.
12.2 Understand the importance of the powder feed system.
12.3 Describe various powder feed systems.

- 12.4 Understand the function and importance of Venturi powder-feed devices.
- 12.5 Know the factors to consider when selecting an electrostatic spray gun.

Lesson 13 - Powder Spraying Booths

At the end of Lesson 13 you should be able to:

- 13.1 Describe the types of powder booth in use.
- 13.2 Describe the methods and equipment needed to recover powder.
- 13.3 Discuss the issues relating to manual or automatic application associated with colour change requirements.

Lesson 14 - Application of Heat (Stoving)

At the end of Lesson 14 you should be able to:

- 14.1 Understand the purpose of the heating/stoving operation.
- 14.2 Understand the inter-relationship of temperature/time parameters.
- 14.3 Describe the types of oven in use.
- 14.4 Know the important design features of heating plant.

Lesson 15 - Ancillary Operations

At the end of Lesson 15 you should be able to:

- 15.1 Know the importance of good design of jigs and fixtures.
- 15.2 Describe different methods for the stripping of powder coatings.
- 15.3 Know the advantages and disadvantages of different powder coating stripping techniques.
- 15.4 Understand the need for masking parts of components when powder coating.
- 15.5 Understand the benefits of automation and robots for powder spraying operations.

SECTION H - SERVICES

Lesson 16 - Water chemistry, utilities and prime services

At the end of Lesson 16 you should be able to:

- 16.1 Appreciate the meaning and purpose of utilities and prime services in the Finishing Shop.
- 16.2 Realise the importance of water and know what it is.
- 16.3 Be aware of the properties of water.
- 16.4 Know about the treatment of water.
- 16.5 Be aware of the quality of deionised water.
- 16.6 Appreciate the value of water as a heat transfer fluid for cooling and heating.
- 16.7 Understand the key properties of utilities and services.
- 16.8 Be knowledgeable of the Factory Coding System.

SECTION I - CONTROLLING THE PRODUCT AND THE PROCESS

Lesson 17 - Testing of Powder Coatings

At the end of Lesson 17 you should be able to:

- 17.1 Understand how powder properties influence the efficiency of the coating process.
- 17.2 Describe standard methods of ensuring that powder coatings meet quality standards.
- 17.3 Use selected test methods to assess the properties of powder coatings.

Lesson 18 - Solving Powder Coating Problems

At the end of Lesson 18 you should be able to:

- 18.1 Know how to identify most common causes of problems.
- 18.2 Appreciate the benefits of process control.
- 18.3 Know how to use control charts.

SECTION J - HEALTH, SAFETY AND ENVIRONMENTAL ISSUES IN SURFACE FINISHING

Lesson 19 – Health, Safety and Environmental Legislation

At the end of Lesson 19 you should be able to:

- 19.1 Understand what is required of an employer under the Health & Safety at Work Act (1974).
- 19.2 Understand what is required of an employee under the Health & Safety at Work Act (1974).
- 19.3 Be aware of the requirements of Control of Substances Hazardous to Health (COSHH).
- 19.4 Understand the need for risk assessments and their relevance to COSHH and the Health and Safety at Work Act.
- 19.5 Be aware of the use and meanings of Risk and Safety phrases.
- 19.6 Be aware of REACH.
- 19.7 Understand the role of the Environmental Protection Act and how it relates to surface finishing.
- 19.8 Be aware of other legislation that may affect the processes used in surface finishing.

Lesson 20 – Health and Safety Hazards and Precautions

At the end of Lesson 20 you should be able to:

- 20.1 List and identify the most important items of safety equipment in a surface finishing department.
- 20.2 Identify the most common hazards to be found in the workplace.

- 20.3 Be aware of specialist hazards to be found in different type of surface finishing areas.
- 20.4 Know how to avoid any short and long term effects of these hazards.
- 20.5 Know how to avoid a fire and to mitigate its effects.
- 20.6 Discuss the importance and role of training in the prevention of accidents.
- 20.7 Be aware of the hazards in the powder coating environment.
- 20.8 Know how to design plant and equipment for powder coating to reduce the risk of accidents.

Lesson 21 – The Treatment and Disposal of Finishing Wastes

At the end of Lesson 21 you should be able to:

- 21.1 Discuss how the discharge of hazardous effluents can cause danger, damage or loss.
- 21.2 List the main hazardous wastes from Surface Finishing.
- 21.3 Explain how heavy metal ions can be removed by alkaline precipitation and flocculation.
- 21.4 Discuss how to minimise the amounts of waste produced.
- 21.5 Discuss methods for reducing water usage.
- 21.6 Identify how energy is wasted.