

PAINTS AND
COATINGS
SKILL COUNCIL



Participant Handbook

Sector
Paints and Coatings

Sub-Sector
Application

Occupation
Wood Polishing

Reference ID: **PCS/Q5004, Version 2.0**
NSQF Level 4



Wood Polisher

Published by

**PAINTS AND
COATINGS
SKILL COUNCIL**



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Printed in India

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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. ”



PAINTS AND
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PAINTS AND COATINGS SKILL COUNCIL

for

SKILLING CONTENT : PARTICIPANT HANDBOOK

Complying to National Occupational Standards of
Job Role/ Qualification Pack: 'Wood Polisher' QP No. 'PCS/Q5004 NSQF Level 4'

Date of issuance: July 25th, 2017

Valid up to*: July 25th, 2019

*Valid up to the next review date of the Qualification Pack or the
'Valid up to' date mentioned above (whichever is earlier)

Authorised Signatory
(Paints and Coatings Skill Council)

Acknowledgements

This handbook would not have been possible without the help of our friends in National Institute of Coating Technology Pune, who made available plenty of material while training candidates at their academy. Their generous support is gratefully acknowledged.

We would also like to acknowledge here the long hours spent by our colleagues in editing and improving the drafts to make the final work more reader friendly and compact.

Paints and Coatings Skill Council

About this book

This Participant Handbook is designed to train participants for the job ‘Wood Polisher’, a NSQF approved level 4 qualification covered by QP reference no. PCS/Q5004.

The job involves painting wooden surfaces, particularly used for furniture and decorative purposes NSQF

This QP consists of 6 NOS, each dealt under a separate unit as follows.

Reference ID – PCS/Q5004

Each “National Occupational (NOS)” is covered across unit/s.

1. PCS/N5006 Engage with customer for wood polishing service.
2. PCS /N5007 Prepare and paint/polish the wooden surface.
3. PCS/N5013 Conduct entrepreneurial activities for decorative paints.
4. PCS/N9901 Coordinate with colleagues and/or Customers.
5. PCS/N9902 Maintain standards of product/service quality.
6. PCS/N9903 Maintain OH and S standards and follow environmental norms.

Symbols Used



Key Learning Outcomes

The key learning outcomes are listed at the beginning of each module. These outline the focus areas that the learners will cover in every module.



Tips

Wherever possible, tips are included in every module. They provide additional insight to learners on a particular topic being discussed.



Steps

These provide step-by-step instructions for a specific process.



Notes

Notes at the end of each module is a space for learners to list down their key points related to the topic.



Summarize

These provide the summary or the takeaways of the unit.



Unit Objectives

These are listed at the beginning of each unit under every module. They highlight the focus areas that the learners will cover in every unit.

Table of Content

S.No	Modules and Units	Page No
1.	Introduction	1
	Unit 1.1 - About Paints and Coatings Sector in India	3
	Unit 1.2 - Classification of Paints and the Coatings Industry	5
	Unit 1.3 - Basics of Paint Chemistry and Paint Manufacture	6
	Unit 1.4 - Colour	10
	Unit 1.5 - Colour Standards	14
	Unit 1.6 - Types of Finish	15
	Unit 1.7 - Gloss Measurement	17
	Unit 1.8 - What is Wood Polishing?	18
	Unit 1.9 - Job Role of a Wood Polisher	34
2.	Engage with the Customer (Applicable NOS – PCS/N5006)	37
	Unit 2.1 - Conduct and Communication Before Starting Job	39
	Unit 2.2 - Conduct and Communication During Wood Polishing	47
	Unit 2.3 - Conduct and Communication After Completing the Job	48
3.	Surface Preparation and Coating (Applicable NOS – PCS/N5007)	49
	Unit 3.1 - Wood Polishing Sequence	51
	Unit 3.2 - Sanding	53
	Unit 3.3 - Wood Fillers / Putty	60
	Unit 3.4 - Wood Coating Application Methods	65
	Unit 3.5 - Paint Circulation System	67
	Unit 3.6 - Spray Application	68
	Unit 3.7 - Finishing Process	76
	Unit 3.8 - Drying of Different Paint and Coating Systems	80
	Unit 3.9 - Cleaning After Application	83
4.	Coordinate with Colleagues and Customers (Applicable NOS – PCS/N9901)	85
	Unit 4.1 - Interacting with Superior	87
	Unit 4.2 - Communicating with Colleagues	88
	Unit 4.3 - Communicating Effectively with Customers	89
5.	Maintain Standards of Product / Service Quality (Applicable NOS – PCS/N9902)	93
	Unit 5.1 - Meeting and Exceeding Customer Expectations	95
	Unit 5.2 - Coating Defects, Tests and Standards	97
	Unit 5.3 - Your Responsibility as a Wood Polisher	110
	Unit 5.4 - Prevention of Injuries	111
6.	Maintain OH&S Standards and Follow Environmental Norms (Applicable NOS – PCS/N9903)	113
	Unit 6.1 - Responsibility Regarding Safety	115
	Unit 6.2 - Waste Disposal	119
	Unit 6.3 - Use Safety Tools and Personal Protective Equipment (PPE)	120



7.	Conduct Entrepreneurial Activities (Applicable NOS – PCS/N5013)	133
	Unit 7.1 - Who is an Entrepreneur?	135
	Unit 7.2 - Types of Enterprises	136
	Unit 7.3 - Customer Profile and Marketing	137
	Unit 7.4 - What is Networking?	138
	Unit 7.5 - Marketing of Product/Service	139
	Unit 7.6 - Maintaining Accounts and Complying with Statutory Requirements	140
	Unit 7.7 - Basic Business Terminology	141



**PAINTS AND
COATINGS
SKILL COUNCIL**



1. Introduction

- Unit 1.1 - Paints and Coatings Sector in India
- Unit 1.2 - Classification of Paints and Coatings Industry
- Unit 1.3 - Basics of Paint Chemistry and Manufacture
- Unit 1.4 - Colour
- Unit 1.5 - Colour Standards
- Unit 1.6 - Types of Finish
- Unit 1.7 - Gloss Measurement
- Unit 1.8 - What is Wood Polishing?
- Unit 1.9 - Job Role of a Wood Polisher

Scan the QR code for video



Key Learning Outcomes



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

1. Discuss the paints and coatings sector in India, and its sub-sectors
2. Describe what is paint and how it is made
3. Name different kinds of paints, their manufacturing techniques and characteristics
4. Explain what a paint system is
5. Discuss the importance of understanding colour and colour standards
6. Gain in-depth knowledge about finish and types of finish
7. Describe your role and responsibilities as a Wood Polisher

UNIT 1.1 About Paints and Coatings Sector in India

Unit Objectives

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

1. Explain what paints and coatings are
2. Describe the purpose behind the use of paints

Paints are present all around us. Wherever we look we see paint in some form – on walls, doors, floors, furniture, fans, cell phones, gas cylinders, cars, computers and laptops, motorcycles and scooters, trains and buses, shop signage and road signs, bridges, electric poles, pipelines—the list goes on. As you see, there are very few articles or items that we see or use in our daily lives that do not carry some coating or the other. You will be surprised to know that even metal cans that are used to pack food and beverages, glass bottles carrying soft drinks and other products, metal tips of shoe laces, door knobs and handles, airport runways and factory rooftops, aeroplanes and ships – all have coatings applied on them for protection, indication or decoration. The paint industry adds so much colour and convenience to our everyday lives that it would be difficult to imagine a world without it! As you look around and see the universal presence of coatings everywhere, you would also realise that the paint and coatings field is quite complex.

What is the purpose behind the use of paints? Decoration is certainly one important reason why paints are used. They lend colour and beauty to objects on which they are applied and greatly increase their visual appeal. An equally important reason for the use of paints is protection. The life of products, especially those made of metal or wood is enhanced if an appropriate coating is applied on them. The universal use of iron and steel on various industrial and household products would be unthinkable in the absence of coatings to protect them. Likewise, Wooden furniture and articles are known to last centuries if they are protected by regular application of coatings on them. Our ancestors understood this, which explains why varnishes and lacquers are as old as civilisation itself.

Coatings are also used for “indication”. All of us are aware that red is a colour used to indicate danger or fire and hence fire tenders, stop signs and caution/danger signals are invariably painted red. Ambulances and hospital furniture are always painted white while school buses are yellow. You will find that paints help to identify and make life convenient for us. White road marking, red post boxes, green park fencing, black and yellow taxis and auto rickshaws – one can think of many such examples.

Paints also help to improve cleanliness and hygiene. Coatings with antifungal properties help to keep walls in homes and buildings free from fungus especially in damp weather. Coatings used in food cans prevent the contents from spoiling and serve as a protective barrier. Coatings can even help retard fire or enhance the protection against fire. Thus, there are many uses for paints and coatings in our everyday life.

While the common person sees it as being colourful with a great deal of variety, to the technical people formulating and making paint and to those who apply it on surfaces, it is a complex world—of different chemistries and technologies, of a range of demanding and often conflicting requirements of many application challenges and steadily increasing customer expectations.



Fig 1.1 - Paints are used everywhere

Notes



UNIT 1.2 Classification of Paints and the Coatings Industry

Unit Objectives

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

1. List different types of paints
2. Explain characteristics of each type

Broadly, paints are of two types, viz. decorative and industrial.

Decorative paints consist mainly of products that go on interiors and exteriors of buildings as well as on furniture items to make them look aesthetically pleasing. Industrial paints include a wide variety and are further classified under various subgroups, such as Automotive OE, Automotive Refinish, Powder Coatings, General Industrial, Coil Coatings, Protective and Marine Coatings, Packaging Coatings etc.

DECORATIVE	INDUSTRIAL
Building Exteriors	Automotive OE Finish
Building Interiors	Automotive Refinish
Furniture and Wood Finishing	Powder Coatings
	General Industrial Paints
	Coil Coatings
	Protective Coatings
	Marine Coatings
	Packaging Coatings

Notes

UNIT 1.3 Basics of Paint Chemistry and Paint Manufacture

Unit Objectives



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

1. Talk about the components of paint and their types
2. Explain the process of manufacture of liquid and powder paints
3. Explain different paint systems and their features or characteristics

1.3.1 Components of Paints and Coatings

The success of any coating depends on its nature, chemical composition, the physical condition of the substrate and application techniques. The compositions vary considerably depending on the end applications, economics and the durability expectations of the coated components. A typical paint product is a homogenous mixture of pigments, extenders, resins or binders, additives and solvents.

Pigments: Pigments are powder material insoluble in resin, water, or solvents and impart colour and opacity (hiding power) to the paint. They may be organic or inorganic. Combinations of different coloured pigments give a variety of other colours. In metallic colours, aluminium / other metal pigments and effect pigments (pearl mica) are used to impart sparkling / metallic effect.



Fig 1.3.1 (i): Colour pigments



Fig 1.3.1 (ii): White pigment



Fig 1.3.1 (iii): Metallic pigments



Fig 1.3.1 (iv): Extender

Extenders: Extenders are economical minerals added to increase the pigment content of the paint and contain the cost. They give filling properties, increase bulk volume and add certain desired properties to the paint. Calcium carbonate is a typical extender.

Resins or Binders: Resins are prepared by a chemical process called polymerisation. The resin helps to bind the pigment particles together and hence it is also called a binder. It is a major ingredient of any paint and is responsible for the film formation in a paint. The paint performance depends mainly on the type and quality of resin. Different resins are used in paints depending on the end use. Resins may be solvent based or water based.



Fig 1.3.1 (v): Resins used in coatings



Fig 1.3.1 (vi): Types of resins

Additives: Additives are used in small quantities for enhancing certain desired properties like pigment wetting and dispersion, ease of application, flow and levelling, drying, curing, UV resistance, colour stability etc. In general, additives upgrade the performance properties of paint. Examples – anti-settling agent, anti-skinning agent, anti-sag agent, flow modifier, adhesion promoter, de-foamer, wetting agent, driers, matting agents etc.



Fig 1.3.1 (vii): Additives in liquid and powder form

Solvents: These are liquids used to reduce the viscosity of paint so that it can be easily applied on the surface. Solvents can be classified as aliphatic (mineral turpentine), aromatic (xylene, toluene), alcohols, ketones and esters. For water-based products, water is the solvent.

A solvent may be a true solvent, co-solvent or a diluent. Different solvents have different ability to dissolve resin. A solvent that dissolves a resin is the true solvent for that resin. Co-solvent dissolves the resin in the presence of the true solvent. A diluent is used only to reduce the viscosity. There are fast evaporating, medium evaporating and slow evaporating solvents. Generally, a combination of different solvents is used to achieve the desired film performance.

Powder coating, which is paint in a dry powder form, does not require any solvent during manufacture or application. As we shall see in the next sections, the manufacturing process for powder coating differs from that of liquid paints. The equipment used for powder manufacture are also different.

1.3.2 Characteristics of Different Resins

As we have already seen, resin is a major ingredient in paint and is responsible for making the paint into a film. There are different types of resins that can be used to make paint. It is important to understand the characteristics of each resin type as they determine the properties of the final paint.

TYPE OF RESIN	CHARACTERISTICS
ALKYDS	Alkyds are economical resins, mainly used in architectural paints. Enamel or oil paint is based on this resin. Technically, an alkyd is an oil modified polyester. By adding driers (special additive) these paints are made air-drying type. Paint film formation takes place at room temperature.
POLYESTERS	These resins are superior to alkyd resins in performance. They are mainly used in automotive/general industrial paints and powder coatings.
ACRYLICS	These resins have good durability against ultraviolet rays. They are mainly used in automotive clear coats, base coats and mono coats.
EPOXIES	Epoxies have good corrosion resistance, chemical resistance and water resistance properties. They are used mainly in protective coatings. These paints are supplied as base and hardener packed in separate containers. Such paints are called two pack (2K) paints.
AMINO	These are melamine formaldehyde (MF) or urea formaldehyde (UF) resins used for curing and achieving hardness of the paint film. These resins crosslink with alkyd, polyester, epoxy resins and give excellent toughness. This reaction starts at high temperature (above 120° C). Hence, such paints are supplied as one pack (1K) paint. MF resin is widely used in automotive paints.
ISOCYANATE	This hardener reacts with alkyd, polyesters and acrylic resins to form Polyurethane coatings. The crosslinking reaction between the -OH of the resins and -NCO of the isocyanate hardener starts at room temperature, once the two are mixed. Hence these paints are supplied as 2K (base and hardener) packed in separate containers.

1.3.3 Comparison of Paint Systems

We have already seen that there are many different types of resins that can be used in the manufacture of paints. Paint technologists refer to these as different paint chemistries. Thus, a paint chemistry is defined by the binders or resins that are used to make it.

Paints from different chemistries vary in properties such as curing time and temperature, appearance, mechanical properties, durability, chemical resistance, cost etc. Thus, depending on the end use requirements of the painted product / surface, the right chemistry is chosen.

Paints are classified based on the type of resin used such as alkyd-based paints, polyester paints, acrylic paints, epoxy paints, alkyd-amino paints, polyurethane paints etc. Further, paints are classified by:

- The physical state - liquid paint, stiff paint, powder coating
- Mode of thinning: water thinnable / solvent thinnable
- End use: architectural, industrial, protective coatings, automotive coatings etc.
- Mode of drying: air drying, forced drying, baking / stoving, UV cured
- Order of application: Undercoats (primer, primer surfacer) and top coats

In the case of powder coatings, the types of powders based on resin chemistry include epoxy, epoxy-polyester, pure polyester, polyurethane and acrylic powders.

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- Order of application: Undercoats (primer, primer surfacer) and top coats

In the case of powder coatings, the types of powders based on resin chemistry include epoxy, epoxy-polyester, pure polyester, polyurethane and acrylic powders.

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UNIT 1.4 Colour

Unit Objectives



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

1. Explain the concept of colour
2. Talk about different categories of colour
3. Discuss how we perceive colour

1.4.1 Colour Concepts

When we speak of paints, the first thought that comes to our mind is that of colour. We always associate paints with colour. We see the colour of an object when light falls on it and gets reflected. In darkness, we see no colour. Similarly, under different light sources such as sunlight, fluorescent light or sodium vapour street lights the same object will appear different in colour. So the colour that we perceive depends on the light source. When we speak of colour, we normally refer to what is seen in day light. The colour of an object that we perceive changes with the light source.

Colours can be classified as follows:

Primary colours

- Red, yellow and blue are called primary colours.
- They cannot be obtained by mixing together other colours.

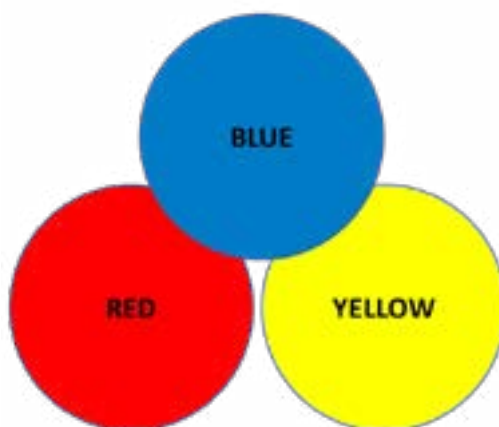
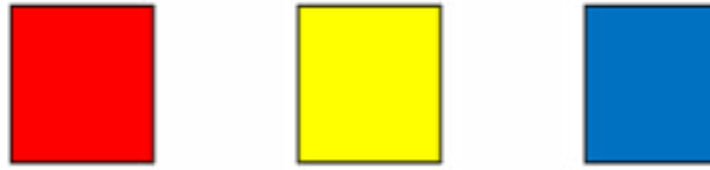


Fig 1.4.1 (i): Primary colours

Secondary colours

- Orange, green and violet are called secondary colours.
- They are obtained by mixing in equal amounts two adjoining primaries.

PRIMARY COLOURS



SECONDARY COLOURS



Fig 1.4.1 (ii): Secondary colours

Mixing of colours

- Yellow + Blue = Green
- Red + Yellow = Orange
- Blue + Red = Violet

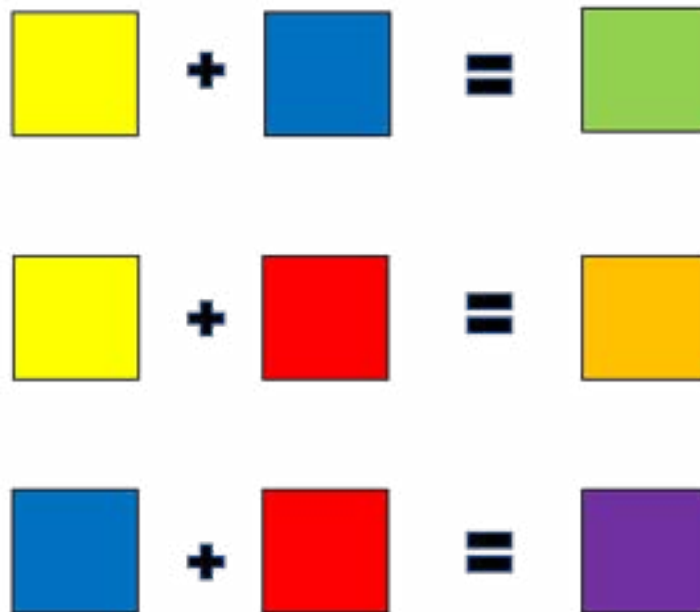


Fig 1.4.1 (iii): Mixing of colours

Intermediary colours

When the primaries are not mixed in equal amounts, intermediary colours are formed, such as yellow-green (chartreuse), green-yellow (apple green), etc.



Fig 1.4.1 (iv): Intermediary colours (pinsdaddy.com)

Tertiary Colours: Tertiary colours are obtained by mixing two secondary colours, such as orange with green (olive), green with violet (slate) or violet with orange (russet).



Fig 1.4.1 (v): Tertiary colours (firstascentdesign.com)

Complimentary Colours: Colours that appear opposite each other on the colour wheel are called complimentary colours. Complimentary colours include: red and green, yellow and blue etc. A complimentary colour is often used to reduce the chroma (brightness or intensity) of its opposite. When two complimentary colours are mixed in equal parts, although theoretically they should produce black, they produce neutral a greyish dark brown.



Fig 1.4.1 (vi): Complimentary colours (copicmarkertutorials.com)

	Warm Colours	Cool Colours
HUES	Reds Yellows Oranges Red violets	Blues Blue-greens Blue-violets
NATURE	Vivid, bold	Calming, soothing
USUALLY DEPICT	Sun, fire, heat, warnings	Water/water bodies, cold environs, freshness



Fig 1.4.1 (vii): Warm and cool colours (webflow.com)

Notes 

UNIT 1.5 Colour Standards

Unit Objectives



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

1. Explain what are colour standards and why they are useful



Fig 1.5: RAL shade card

RAL is used for information defining standard colours for paint and coatings. It is the most popular central European Colour Standard used today. The colours are used in architecture, industry and road safety. The human eye distinguishes about ten million colour shades. How can we tell exactly which colour we mean? With the use of RAL colour charts!

Since 1927, RAL has created a uniform language when it comes to colour. It has standardised, numbered and named the abundance of colours. These standards are easily understandable and applicable - worldwide. Some example colours from the RAL colour chart are mentioned below. The first digit relates to the shade of the colour:

1xxx Yellow RAL 1000	Green Beige - RAL 1034 Pastel Yellow (27)
2xxx Orange RAL 2000	Yellow Orange - RAL 2012 Salmon Orange (12)
3xxx Red RAL 3000	Flame Red - RAL 3031 Orient Red (22)
4xxx Violet RAL 4001	Red Lilac - RAL 4010 Telemagenta (10)
5xxx Blue RAL 5000	Violet Blue - RAL 5024 Pastel Blue (23)
6xxx Green RAL 6000	Patina Green - RAL 6034 Pastel Turquoise (32)
7xxx Grey RAL 7000	Squirrel Grey - RAL 7047 Telegrey 4 (37)
8xxx Brown RAL 8000	Green Brown - RAL 8028 Terra Brown (19)
9xxx White/Black RAL 9001	Cream - RAL 9018 Papyrus White (12)

UNIT 1.6 Types of Finish

Unit Objectives



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

1. Explain finish
2. List different types of finish in common use

Besides colour there are two other aspects describing the appearance of a finish that you will come across – ‘Gloss’ and ‘Type of finish’. Gloss refers to the shine in the paint film. A high gloss surface appears mirror like whereas a matt finish is dull or flat. The gloss level is expressed as percentage of the light that is reflected from a surface in a mirror like fashion. Since the extent of reflection also depends on the angle at which the surface is held, gloss level is measured and expressed as a value at a specific angle.

FINISH	GLOSS LEVEL
Dead Matt	0-15%
Matt	15-30%
Egg Shell Matt	30-45%
Satin	45-60%
Semi Glossy	60-75%
Glossy	75-90%
High Gloss	90% +

Type of finish refers to the texture or the visual feel of the finish. Examples of common types of finish are illustrated below.



Fig 1.6 (i): Gloss, semi-gloss and matt finish

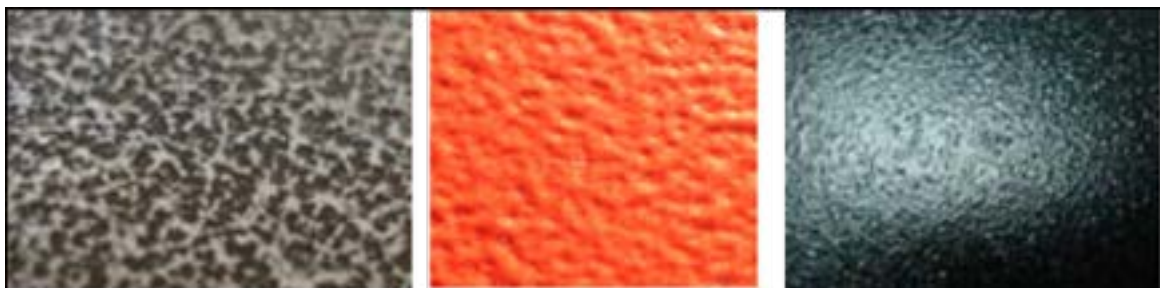


Fig 1.6 (ii): Hammer tone finish, structure finish and coarse texture

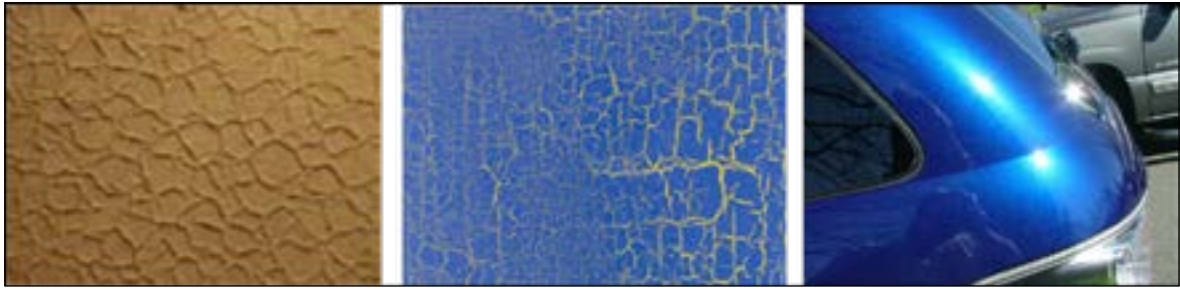


Fig 1.6 (iii): Wrinkle, antique and metallic finish

Notes

[illegible]

UNIT 1.7 Gloss Measurement

Unit Objectives



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

1. Explain gloss and its measurement
 2. Describe how gloss value is expressed
- Gloss is measured by a gloss meter at different angles
 - Gloss reading depends on the angle at which it is measured. So, gloss is always expressed as a percentage at an angle (e.g.: 60% at 20°)
 - An angle of 60° is most common in the coating industry. Usually recommended for medium gloss levels
 - An angle of 20° is used to achieve a more differentiated result of high gloss surfaces usually recommended for Automotive class “A” finish using liquid coatings
 - An angle of 85° is used to achieve a more differentiated result of low gloss surfaces, not so popular in coating industry

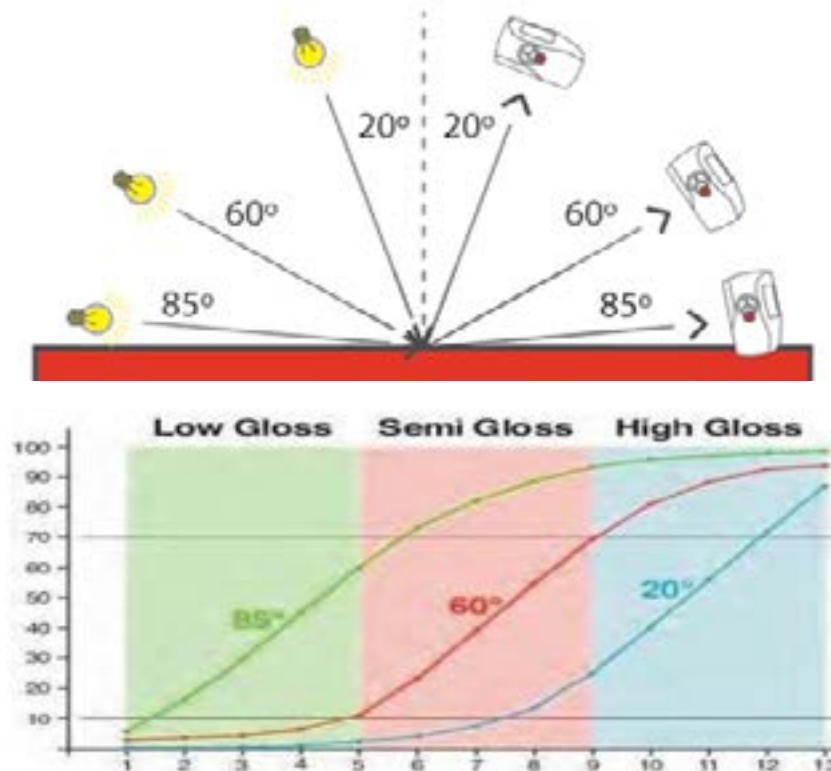


Fig 1.7: Reading gloss at different angles

UNIT 1.8 What is Wood Polishing?

Unit Objectives



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

1. Describe what a wood polisher does
2. Discuss different types of woods and finishes that go on them
3. Visually identify wood and different kinds of wood like materials

Wood is an expensive material with high aesthetic potential. Polishing, application of paint or varnish on wood brings out its full beauty while preserving it for the future.

A wood polisher or painter is a person who applies polish, paint or varnish on wooden surfaces. He needs to have good knowledge of various types of wood and their behaviour under different weather conditions and when coated with different finishes. He also needs to possess skills in preparation of wood surfaces and application of different types of finishes to meet the requirements of the customer.

1.8.1 Types of Wood Finishes

Wood is a versatile material which renders it suitable for a variety of applications. Construction, furniture, handicrafts, household articles, toys, railway sleepers, passenger coaches, ships, coastal installations, musical instruments and sports equipment are amongst the many uses that timber is put to. Each application exposes the wood to certain specific service conditions. Besides, decorative attributes such as colour, finish etc. will also vary depending on the application and customer preference. This calls for the selection of the right type of wood and the correct finish.

An important consideration in selection of the finish is whether it will be subject to outdoor exposure. Based on this criterion, a finish may be classified as an interior finish or an exterior finish.

INTERIOR FINISH	EXTERIOR FINISH
<ol style="list-style-type: none"> 1. These coatings are used on surfaces where the job is not exposed to direct sunlight. 2. Typical examples are flooring within the house and interior furniture. 	<ol style="list-style-type: none"> 1. These coatings are used on surfaces where the job is exposed to direct and/or reflected sunlight and different outdoor weather conditions. 2. Typical examples are balcony railings, outdoor seating furniture.

1.8.2 Structures in Wood

A piece of wood under a microscope shows that it is made up of numerous small cells with rigid walls and hollow centers. These cells, which are usually about 10 times as long as they are wide, are aligned with their long axis vertical in the growing tree.



Fig 1.8.2: Rings, knots, grains and structures in the wood structure

1. **Rings** in the wood structure show the age of the wood.
2. **Knots** are the remains of branches which originate from the centre of the tree and become embedded in the trunk as the tree grows.
3. **Grain** is the general direction of the fibres relative to the axis of the tree.
4. **Figure** refers to the markings seen on the cut surface of the timber formed by the structural features of the wood.
5. **Texture** of the wood depends on the structural character of the wood. Timbers with small cells produce finer textured timber, those with large cells produce a coarser texture.

1.8.3 Moisture Content in Wood

Wood will always contain some water in the form of dampness. Wood dries naturally but over a long time. The rate depends on the species of wood and the diameter of the wood log. If cut in small pieces, wood seasons faster. For use in furniture the recommended moisture content is 8 to 14 %.



*Fig 1.8.3: Wood moisture meter (amazon.com),
Wood moisture being checked (generaltools.com)*

1.8.4 Seasoning of Wood

The process of drying of the cell cavities in a controlled way, such that they remain intact and undamaged is called seasoning. Too rapid loss of moisture can cause shrinkage of the cell wall, and cells can collapse and rupture leading to warpage, cracks and bending of the wood. The two common methods of seasoning wood are air drying and kiln drying.

AIR DRYING	KILN DRYING
Slow process	Fast process
Drying completely dependant on ambient conditions	Human controlled conditions
Cheap process of wood drying	Comparatively expensive
Usually done for smaller quantities	Method suitable for bulk furniture manufacturers

Air Drying (Natural Method)

Air drying is one of the most common methods available for seasoning wood. It is the oldest and simplest method of seasoning. Air dried lumber is also suitable for exterior use.



Fig 1.8.4 (i): Air drying (clarklumbercompany.com)

Kiln Drying (Artificial Method)

Kiln drying of lumber is the more effective, faster and economical method available. Drying rates in a kiln can be carefully controlled. Defects and losses can be reduced to minimum. Drying time is also greatly reduced compared to natural air drying and is predictable.



Fig 1.8.4 (ii): Kiln drying (wellons.com)

1.8.5 Types of Wood



Fig 1.8.5 (i): Teak



Fig 1.8.5 (ii): Mahogany



Fig 1.8.5 (iii): Shesham

Teak is hard and moisture resistant wood. It resists warping, cracking and decay. It is used in fine furniture, panelling, shipbuilding, doors, window framing, flooring and general construction.

Mahogany is a fine variety of hardwood, with reddish tint. It resists swelling, shrinking and warping. It is extensively used for cabinets, boat construction, wood facings and veneers.

Shesham is a rich medium brown wood with deep grains. The wood variety is highly durable, can be easily carved and is exclusively used for making furniture, wardrobes and cabinets.



Fig 1.8.5 (iv): Maple



Fig 1.8.5 (v): Walnut



Fig 1.8.5 (vi): Oak

Maple is a finely textured wood variety with immense strength and hardness. With moderate shrinkage, this wood machines well and is best used in flooring, fine furniture and woodenware such as bowling alleys.

Walnut is a very strong and finely textured hardwood. It resists shrinkage and warpage and is very easy to work with. It is used for making gun butts, solid and veneered furniture, novelties, cabinetry and wall panelling.

Oak is an exclusive variety of hardwood. It possesses good bending qualities in addition to durability. It finishes well and resists moisture absorption. The hardwood is good for furniture, trimming, boat framing, desks and flooring.



Fig 1.8.5 (vii): Balsa



Fig 1.8.5 (viii): Cherry wood



Fig 1.8.5 (ix): Pine

Balsa is a very light wood with very good strength to weight ratio. It is universally used to make model aircrafts. It lends itself to cutting and shaping and is glued easily with simple hand tools.

Being close-grained, **cherry wood** is a hardwood that resists warping and shrinking. It has a distinct feature of reddenning, when exposed to sunlight. It ages well and is used in cabinet making, boat trim, novelties and solid furniture handles.

Pine possesses a uniform texture and is easy to work with. It finishes well and resists shrinkage, swelling and warping. It is widely used in house construction, paneling, furniture, molding and for making boxes.

Notes





Fig 1.8.5 (x): Hemlock



Fig 1.8.5 (xi): Cedar



Fig 1.8.5 (xii): Fir

Hemlock is lightweight and machines well. Being non-resinous, it is uniformly textured and has low resistance to decay. It is used for construction lumber, planks, doors, boards, panelling, sub flooring and crates.

Cedar has a sweet odour and is reddish in colour. It is easy to work with, uniform in texture and resistant to decay. Cedar is extensively used in chest making, fencing, closet lining, shingles, posts, dock planks, novelties and Venetian blinds.

Fir has uniform texture and low resistance to decay. It is non-resinous, works easy and finishes well. Fir is used for furniture, doors, frames, windows, plywood, veneer, general millwork and interior trim.



Fig 1.8.5 (xiii): Red wood



Fig 1.8.5 (xiv): Rose wood



Fig 1.8.5 (xv): Spruce

Being light in weight, **redwood** is durable and easy to work with. It has a natural resistance to decay and is good for making outdoor furniture, fencing, house siding, interior finishing, veneering and panelling.

Rosewood is a dark reddish-brown coloured variety of hard wood. It has exclusive fragrance and is close grained. It is good for making musical instruments, piano cases, tool handles, art projects, veneers and furniture.

Spruce is a strong variety of wood that finishes well and has low resistance to decay. It possesses moderate shrinkage and is light weight. Thus, good for making masts and spars for ships, aircraft, crates, boxes, general millwork and ladders.

1.8.6 Wood Like Substrates

Plywood



Fig 1.8.6 (i): Plywood
(roberts-plywood.com, dreamhomeguide.in)

Plywood is a sheet material manufactured from thin layers of wood. These sheet layers are glued and pressed together in a hot press. They are layered in such a way that the wood grain pattern in each sheet is perpendicular to the pattern in the previous sheet. As a result, the dimensional stability of plywood is better than solid wood. The properties of plywood will be decided by the type of glue / resin used. Many types of plywood like commercial ply, marine ply etc., with varying thicknesses are available in market.

Finger Jointed Lumber

Finger jointed lumber (also known as a comb or box joint) consists of many small pieces of wood that are glued together and have finger joints that help to improve strength and to produce large sheets. This process can eliminate knots and other normal wood defects. A finger joint is called such simply because, it resembles interlock fingers of your hands at a ninety-degree angle.

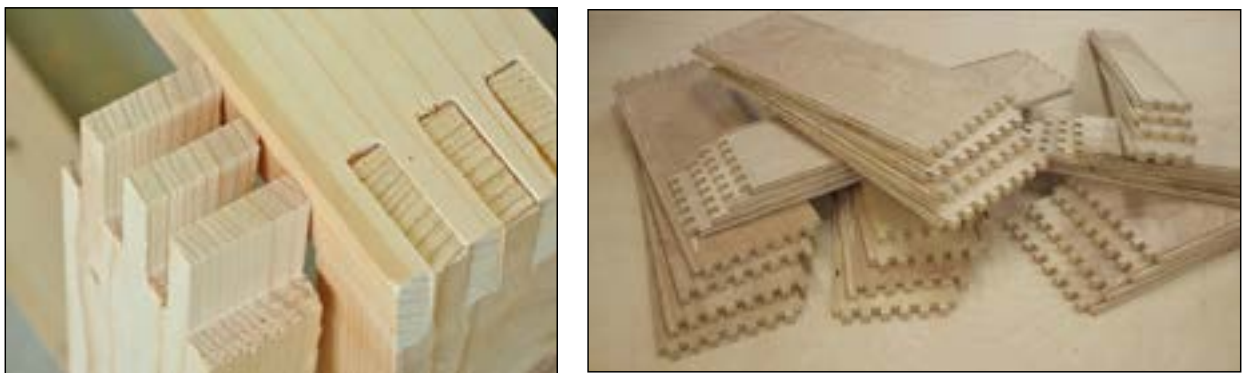


Fig 1.8.6 (ii): Finger jointed lumber
(woodnewsonline.com, thespruce.com)

Particle Board



Fig 1.8.6 (iii): Particle board (indiamart.com, peacockmy.com)

Particleboard is produced from dried and graded chips / wood saw mixed with resin which are formed into boards by curing in a hot press. Board thicknesses range from 6 - 25 mm, although panels up to 70 mm thick can be produced. Particleboard has a wide variety of uses in building, such as flooring, cladding etc. It is widely used pre-painted or faced with decorative wood veneers, melamine foils or other surface treatments.

MDF – Medium Density Fiber



Fig 1.8.6 (iv): MDF board being cut (youtube.com) & MDF boards (thespruce.com)

MDF - Medium Density Fiber Board is a type of fiber board made from wood or other cellulosic materials, refined into fibers and bound with a resin binder (glue) carried out at high temperatures. MDF has good resistance to warp by moisture and compression. It is dimensionally quite stable with close tolerances and screw holding abilities. It does not have wood grain-pattern by itself. MDF is easier to machine than natural wood and can be laminated and painted to produce many finishes. It can be sawed and shaped very evenly and smoothly - a process which cannot be achieved to the same degree with particle boards.

MDF can be nailed, stapled, sanded and joined with screws just like any natural wood product. It has the mechanical and physical characteristics comparable to solid wood, and in many applications, can be used as substitute for solid wood.

Veneer



Fig. 1.8.6 (v): Veneer strip roll and sheet (lowes.com, homedepot.com)

Veneer are thin slices of wood, that are glued onto MDF or particle board surfaces/panels to imitate furniture made from very expensive solid wood.

Oriented Strand Board (OSB)

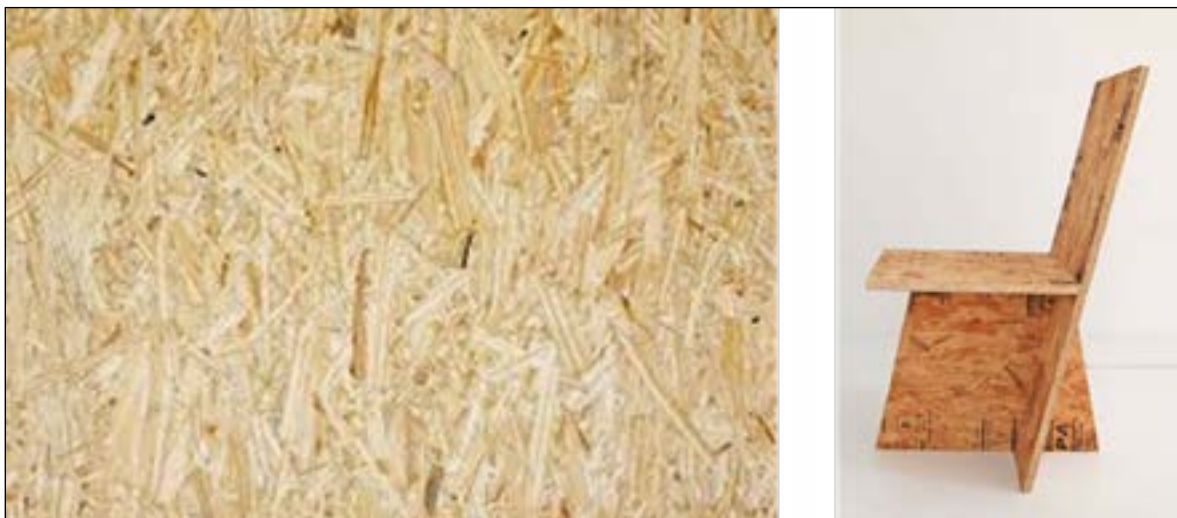


Fig 1.8.6 (vi): Oriented strand boards (dreamstime.com, core77.com)

Oriented Strand Board (OSB) is manufactured from timber strands at least twice as long as they are wide, bonded together with synthetic resin / glue. The alignment of the strands is controlled during manufacture to produce a cross ply effect emulating plywood and resulting in increased strength and stiffness.

WPC Board: These sheets are available in various colours. Only a top coat is needed to have finished surface. For high quality of finishing primer coat along with a top coat is sufficient. WPC is generally used for decorative grill and partitions. Solid coloured painting is done on the WPS sheets. Used on decorative grill, partitions, Kitchen panels and furniture items which are more used in wet areas.



Fig 1.8.6 (vii): Wood Plastic Composite boards used for flooring (home24h.biz)

1.8.7 Types of Coatings Available

- French polish
- Oils, wax and varnishes
- NC lacquers
- Melamine finish
- Acrylics
- Polyurethanes -1 pack and 2 pack
- Polyesters
- Water based coatings

French polish: French polish is a wood finishing technique that results in a very high gloss, with a deep colour and reflective surface. It is a spirit-based material containing shellac (lac). Shellac is the oldest finishing material known, in use since the dawn of civilisation. It is a natural resin, still in use because of its visual appeal and ease of application. Although not as durable as a lacquer or varnish, shellac provides a modest amount of protection. It is not recommended for table tops, chairs and kitchen cabinets due to its low wear resistance. Shellac polish is alcohol based which makes it very fast drying, so it is less likely to collect dust. It is often too thick to apply with a brush and requires thinning with denatured alcohol before it can be brushed. This finish requires a fast application speed. This can also be applied with cotton rags. The application calls for a high level of the operator's skills.

Shellac is available in a range of colours from clear to an orange/amber. Orange/amber shellac is known for the warm tones it gives to wood. Multiple coats of French polish give excellent look to furniture. However, it is less durable and used only on interior articles, poor in water resistance, alcohol resistance, heat resistance and abrasion resistance. Articles finished with French polish need regular maintenance.



*Fig 1.8.7 (i): A fine example of French polished guitar
(myoldstuff.co.uk)*



*Fig 1.8.7 (ii): Specimens post French polish
(goodwinsfrenchpolishers.co.uk, myoldstuff.co.uk)*

Oils, varnishes and waxes: Oils and waxes are also widely used as coatings. These types of finishes have been in vogue for centuries to treat and preserve wood. Oils are different from most other finishes in the market because they seep into the wood and penetrate the wood fibres. As a result, oil finishes cannot be built up to a thick coat like polyurethane or varnish. They offer less protection but are also easier to apply which is their primary advantage. Another advantage is that simply applying more oil by cotton rag can often repair minor scratches. Direct application of oils, waxes and varnishes also gives excellent look to wood, but durability is poor as oils and wax do not have good resistance properties and hence used for interior articles only. Generally, linseed oil and tung oil are used. The drying of oils is very slow. So, it takes more time to recoat.

Varnishes offer better protection than oils. The level of protection increases with additional layers. The primary limitation of varnish is that it is slow drying and thus can allow dust to settle.

Waxes are widely used in economical and natural wood coatings. But they are less resistant to heat, wear and tear, less resistant to water, alcohols, solvent etc. Bees wax mixed in turpentine can also be used and it gives excellent finish after buffing.



*Fig 1.8.7 (iii): Oil and wax finishing
(thefurnitureconnoisseur.com, finewoodworking.com)*

Nitrocellulose (NC based coatings): Nitro-cellulose or Cellulose Nitrate is used in NC lacquers for fast drying re-finishing automotive and wood coatings. NC dries very fast and forms a hard film. The durability of NC based film is not very good and hence is mainly used for coating interior articles. These days use of NC has reduced due to development of synthetic resins like acrylics. An NC based coating cures by evaporation of the thinner. Cured NC film can dissolve or soften with NC thinner. NC cured film is hard, more resistant to water and heat as compared to French polish. NC is widely used in wood coatings as wood filler, sanding sealers and topcoats. A wide variety of formulations can be prepared according to properties required. NC lacquers can be applied by cotton rags, brush, spray etc. NC must not be overcoated with PU or Melamine.



Satin Painted Finish



Wax Polish Finish



NC Glass Finish

*Fig 1.8.7 (iv): Different finishes
(mbwfurniture.files.wordpress.com)*

Melamine: This also is known as acid cure or cold cure system or catalysed varnish. Melamine is a special type of coating. It cures by the cross-linking of alkyd and amino resins with acids as a catalyst for the reaction. The blend of toughness (hardness and flexibility) and chemical resistance makes it popular for kitchen cabinets, office and institutional furniture, and other interior wood applications requiring moderate durability. The great limitation of this coating is long-term formalin emission, which can be harmful for human health. It is very important to ensure that the hardener to base ratio is correctly maintained. Too little hardener will slow the cure rate and leave the varnish soft and less

chemical-resistant forever. Too much of hardener will shorten the pot-life, cure too fast, and make it too brittle to withstand the expansion and contraction of wood, leading to cracks.

Polyurethane: Polyurethane is a polymer, obtained by reaction of poly-isocyanates with certain hydroxyl -OH containing compounds that provide a good cross linkage and excellent properties to the film. Polyurethane coatings are known to possess excellent adhesion over all substrates, excellent gloss, abrasion resistance and resistance to a range of chemicals. Urethane alkyds are chemically less reactive and show yellowing tendency when used outdoor. Urethane alkyds are fast drying and exhibit moderate chemical resistance. Urethane alkyds are modified with silicones and offer better resistance to weather and chemicals. Acrylic/ Polyester resin crosslinked with aliphatic polyurethane gives the best durability and hence is generally used for coatings exterior use articles.

2 pack polyol-based urethanes: In this system one component is the base compound and the second component (hardener) is the isocyanate. The cured film of PU is hard, flexible, has high gloss and excellent gloss retention with smooth finish. A wide range of PU products are available to meet different durability requirements and cost. Interior and exterior grade PUs are available in market. Exterior durable PU coatings are available with corresponding sealers and offer higher flexibility, better resistance to ultraviolet rays, and better non-yellowing (NY) property. Clear coats as well as pigmented finishes are available in all shades and gloss levels. Two pack PUs are widely used in durable furniture industries.

Unsaturated polyester: Unsaturated polyester resins make multi-component systems which cure at room temperature when the components are mixed in the required proportion. These films have higher mechanical strength, excellent clarity and good chemical resistance. They are capable of high film build suitable for wood finishing. High thickness can be applied in one coat to get excellent gloss. The film has excellent gloss retention property and good water and alcohol resistance. Buffing gives an excellent glossy finish.

Water based wood coatings: Water based coatings use water for dilution hence making them very eco-friendly and increasingly popular. Water-based finishes emit minimum solvent fumes, they show good wear and tear resistance, but they raise the wood fibres and offer only moderate resistance to water, heat and solvents. These films are breathable and can permit moisture passage to prevent blisters.

Water based emulsion: Acrylic and alkyd dispersions available today can substitute solvent based coatings and come close to drying varnishes type coatings in terms of performance, gloss and durability. Emulsion based cured films are porous permitting breathing, so chances of lifting or blister of the film are reduced. This type of emulsions is generally used in exterior coatings with pigmentation and fungistatic agents.

2 component waterborne polyurethane: Use of 2 component waterborne PU coating is recently in demand in wood finishing industry, because of its remarkable properties like faster drying, faster re-coatability, excellent adhesion to wood surface, excellent resistance to solvents, water and chemicals, excellent abrasion resistance, impact resistance, weathering resistance, flexibility and toughness. These are costlier coatings.

Polyurethane water-based dispersion (PUD): These are single component formulations. They have better adhesion and impact resistance, better chemical and solvent resistance, better balance of flexibility and hardness and improved water resistance. Because of the above properties water-based PU dispersion is widely used in wooden parquet flooring, musical instruments, exterior doors and windows.



Fig 1.8.7 (v): UV curing (finehomebuilding.com)

UV curable coatings: It requires specific ultraviolet light source to commence a reaction, transforming a viscous product into a solid product. The UV viscous material cures chemically, cross-linking its ingredients to form an extremely durable solid finish. This transformation occurs rapidly, usually within one second. Two important benefits, durability and curing speed, coupled with its 100% solids composition with no solvent or VOC make it a very popular finish. UV Coating sealer is applied by smooth hair brush and cured by portable UV curable Lamp. After sanding and cleaning the dust UV clear Matt Flooring grade can be applied by fine quality brush and Wooden flooring can be cured by portable UV curable lamp.

1.8.8 Different Effects on Wooden Surfaces

1	SHADING	The shading is done by using spray gun. Dark or light colours of wood stain is sprayed on edges, moulding or corners to create special effects. For this a spray gun having small nozzle and spray pattern is preferred. This needs a high level of operator skill.
2	MARBLE EFFECT	Base plain colour is applied first and after drying, contrast colour of filament paint (a special purpose paint available in market) is sprayed by spray gun at low air pressure. This paint is very thick and during spraying it gets sprayed as thick filaments giving this effect. This is a skilled application.
3	MOTHER OF PEARL EFFECT	Base mother of pearl colour coat (a special purpose paint available in market) is applied and immediately a very fast drying thinner is sprayed by spray gun without air cap at very low pressure. Due to wet paint and thinner evaporation this special effect is achieved. This also needs a high level of operator skill.
4	ANTIQUE BRUSH EFFECT	On any base plain coloured job, contrast colour brush effect is applied unevenly giving special effect. This is a skilled job.
5	WOOD GRAIN EFFECT BY BRUSH	On base colour dark or light colour wood grain figure is drawn by using stiff used brush.



Fig 1.8.8 (i): Marble effect



Fig 1.8.8 (ii): Mother of pearl effect



Fig 1.8.8 (iii): Antique brush effect (pinterest.com)



Fig 1.8.8 (iv): Wood grain effect by brush (diynetwork.com)



Fig 1.8.8 (v): Wood staining done by rag to create patterns (finecutwoodflooring.com)

1.8.9 Comparison Table for Different Coatings

COATING	DRYING PROCESS	FINISHING QUALITY	DURABILITY	USAGE
French Polish	Evaporation	Excellent	Low	Furniture
Oils	Air oxidation	Medium	Low	Sports material
Varnish	Air oxidation	Medium	Low to medium	Low grade furniture
NC lacquer	Evaporation	Medium	Medium	Sports material, handicraft and furniture
Acrylic lacquer	Evaporation	Medium	Medium	Furniture
Melamine/ Acid Cure	Chemical reaction	Medium to High	Good	Furniture, door etc.
Polyurethanes 2K	Chemical reaction	Excellent	Excellent	Furniture - interior and exterior, kitchen panels
Polyester	Chemical reaction	Excellent	Excellent	Furniture - High gloss, kitchen panels
Water based Acrylic	Coalescing	Medium	Medium	Furniture
Water based polyurethane dispersion	Coalescing	Excellent	Excellent	Furniture - interior and exterior, flooring
Water based polyurethane 2K	Coalescing	Excellent	Excellent	Furniture - interior and exterior, flooring
UV curable coatings	By UV lights	Excellent	Excellent	Furniture - High gloss, kitchen panels

UNIT 1.9 Job Role of a Wood Polisher

Unit Objectives



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

1. Clearly state different aspects of a wood polisher's job

Like with all coatings, the results from a wood finishing job depend on three factors: the quality of the wood coating in the can; the wooden surface and the application. Any shortfall in any one of these will result in an inferior finish and hence an unhappy customer. The wood polisher's main role is to effectively manage these three aspects to deliver a satisfactory performance. For a household customer the key concerns are quality, cost and time. So, a good polisher will not only deliver a quality job but also estimate the total cost with reasonable accuracy and get an agreement from the customer on the costs. Having secured the customer's agreement, he will ensure that he stays within what is agreed. The customer also needs to understand the time frames and the likely date by which the polisher will complete the job and exit. Again, the time frame needs to be agreed upon and adhered to.

There is no better advertisement for painting jobs than the word of mouth publicity from a satisfied customer. It is hence important that the overall experience of the customer is good and favourable to the wood polisher. The behaviour, communication and interaction of the polisher with the customer needs to be polite, professional and reasonable.

Wooden furniture is a beautiful addition to any home, and when it's particularly well done, it serves as a long-term asset.



Fig 1.9: Wooden floor being polished (keylocksmithdubai.com)



Tips  Wood is a versatile material used in many applications such as construction, furniture, ships & boats, toys and household articles. In all these applications the wood needs to be finished with a suitable coating. The Wood polisher is the person who does this job. It is a field with good prospects and offers excellent opportunities for growth.

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Scan the QR code for video

A square QR code with three large square markers in the corners, used for linking to a video.



**PAINTS AND
COATINGS
SKILL COUNCIL**



2. Engage with the Customer

- Unit 2.1 - Conduct and Communication Before Starting Job
- Unit 2.2 - Conduct and Communication During Wood Polishing
- Unit 2.3 - Conduct and Communication After Completing the Job

Scan the QR code for video



Key Learning Outcomes

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

1. Explain the importance of correctly engaging with the customer.
2. List steps that would help maintain polite and productive communication with the customer
3. State how you will align your service to customer expectation
4. Spell out the dos and don'ts in managing customer interaction before, during and after the job

UNIT 2.1 Conduct and Communication Before Starting Job

Unit Objectives



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

1. Schedule a visit to the potential customer's site and observe all meeting courtesies
2. Capture clearly and comprehensively all the customer's requirements
3. Systematically assess the time and cost needed to complete the job

2.1.1 Visiting the Customer's Premises

Wood polishing often involves refurbishing furniture in homes and small commercial areas such as a shop or an office. Even in larger premises, at times the job may be restricted to one or two rooms or a small portion of the premises. This may be the case for example when a function is being planned in a part of the premises, or a new room is to be done up for upcoming functions or plain maintenance.

In each of these cases, the job may not be large enough to warrant a contractor. Instead, it may be directly given to a polisher who may carry it out with the help of a couple of assistants. Such situations would entail a high level of interaction between the polisher and the customer before, during and after completion of the job.

Even where the job is large and is being handled by a contractor with several polishers on the site, you will find that your role as a wood polisher often brings you in close proximity to persons from the customer's side. It is very important to manage such situations well so that a positive impression is left in the customer's mind. No matter how good the quality of work is, if the behaviour of people leaves an unpleasant taste, the customer is unlikely to hire the polisher again or provide good references.

The wood polisher must visit the customer on the date and time agreed. Should any problem prevent him from visiting on the scheduled date and time, then he must inform the customer accordingly before the scheduled date and get the customer's agreement on the revised date and time. Being punctual and keeping commitments for visits sets the tone for customer experience. The wood polisher must visit the customer in a presentable condition in clean clothes and neatly groomed. He should carry with him all the necessary tools for the initial meeting and discussion. The tools must include, pencil / pen, note book, measuring tape, samples of various veneers/ stains/ colours and moisture content measuring meter.



Fig 2.1.1: Things you must carry at first meeting

2.1.2 Basic Communication



The essence of good communication is that the receiver of the communication correctly understands what the speaker wishes to communicate. To ensure that, it is important to be a good listener. Listen and understand the customer's requirements and expectation correctly.

Repeat your understanding and confirm with the customer that your understanding is correct. Respond to the customer sincerely and factually. Make sure the customer understood your communication exactly.

DO	DON'T
Speak politely and with respect	Do not raise your voice and speak loudly
Ask for clarification if you do not understand	Do not be argumentative
Use simple language and explain technical terms for the customer's understanding	Be polite and firm on what is not acceptable to you
Remain attentive while in conversation and do not fidget with your mobile or anything else while talking to your customer	Don't talk unnecessarily and about unrelated things
If you do not have an answer to a customer's query, say so. Don't try to cover up with smart talk	Do not be vague
It is important to be honest in all aspects of your interaction	

2.1.3 Understanding Polishing Service Requirement

It is important to begin with a comprehensive understanding of the customer's polishing requirement. To understand the requirement, the following questions can be asked.

- Is the job being done for a special occasion like marriage, festival, etc. or is it a regular maintenance job. If it is for a special occasion, when is the occasion? How many days do you have between now and the special occasion?
- Does the customer have a budget for the job in mind or an estimate of how much he wants to spend?
- What quality of polishing does the customer want? Does the customer want a complete scrape down and application of the entire system? Or an over coating job?
- Will the house/property be unoccupied, or will it have the residents living there during the painting?
- Does the customer have any timelines or target dates by when the painting needs to be completed?

- f. Are there any specific problems the customer needs the painting service to address in the house?
- g. If re-polishing, when was the last time it was polished and what system was used?
- h. What is the general condition of the articles?

2.1.4 Probable Issues Before Starting the Job

Price disagreement: Most customers have a budget for polishing and would like to confirm total costs below this budget. To start with the polisher will inform the customer that there are several qualities in the materials and accessories to suit every budget. The polisher will also advise the customer on ways and means to reduce costs if the customer finds the costs too high. However, the polisher should never recommend measures to reduce costs that will result in poor performance and/or early paint failure. The polisher should stay firm if his quote is reasonable and there is no possibility of any further reduction. He should offer the customer time to think it over and call him if the customer were to change his mind. The polisher should always stay pleasant and agreeable and not show anger, arrogance, sarcasm, disappointment and bad attitude. All these will only harden the customer's position and will also lead to a negative opinion of the polisher.

Material bought by the customer: Some customers will insist that they will procure the material and the polisher will be paid only for his labour. If this method is ok with the polisher, he should be cautious in estimating the quantities required. Dispute and disappointment arises when the customer finds that the polisher has ordered excess quantities. Similarly, he should advise the customer on the right quality of material to be procured and not seen to be pushing for a 'specific' brand making the customer suspicious of ulterior motives. It is important to be neutral and committed to the customer's benefit in selection of materials and accessories. In this type of contract, it is important to give the customer an idea of the time it will take to complete the job. The polisher should know that the first transaction should potentially lead to several transactions and therefore establishing a good and healthy relationship based on mutual respect and trust is very important.

2.1.5 Confirming Important Decisions Before Starting the Job

Disputes and souring of relationships happen when customer and polisher differ in their understanding of important decisions. Therefore, it is ideal if the polisher writes in his notebook and gets the customer's initials in confirmation.

Time lines: Date on which the job will commence and the date on which the job will be completed, and the polisher will exit the site. Care must be taken to make reasonable estimate of time and provide for unforeseen circumstances like absenteeism of polishers, assistants, etc. However, if beyond all these the work gets delayed for whatever reason, the polisher must be honest and inform the customer on the actual causes that resulted in the delay.

Total costs and payment schedule: This is often an area of dispute and misunderstanding. Therefore, the polisher must get the customer's confirmation on the costs and payment schedule. Once this is agreed upon, the painter must not keep asking for advance or payment outside the schedule of payment as this can be a source of irritation for the customer.

- It is possible that the customer may want an additional area to be painted. The painter must get an agreement of the customer on the additional cost and additional time involved. Overlooking both these implications will certainly lead to dispute and disagreements.

- Requests such as change in colour, specifications, etc. must be accommodated if found reasonable and can be managed. The customer should be told of the additional costs and delays, if any and agreement and confirmation obtained.
- Sometimes the customer may request stoppage of work (visitors, functions, sickness, etc.). The painter should be sensitive to the situation and co-operate keeping in mind the customer's convenience. However, he should note down the time lost due to this and get the customers agreement.

2.1.6 Customer Requirements - Colour, Finish, Quality and Cost

The wood polisher needs to understand the customer's requirements of finish for each piece of furniture of the house. He needs to help the customer choose the finish with the help of sample panels. He should also help the customer choose the colours by explaining the harmony or contrast with the other colours in the room.

Wood polishers can also show the customer books with effective and aesthetic colour combinations in various areas of a house with the help of interior decoration catalogues.

- The type of finish the customer requires needs to be ascertained. The customer should know that he can choose from matt, semi-gloss/sheen and glossy finish. The wood polisher ideally should have panels to show different finishes.
- In case of new furniture, the wood polisher should explain the different qualities of wood available and their relative merits and demerits. For example, the customer can use plywood, MDF or veneers and the wood polisher should explain the cost differences and the features of each substrate to help the customer decide on what suits him best. It will be of help to the customer if the wood polisher carries Product Data Sheet of the products for the customer to verify the relative features.
- An important consideration for the customer is the total cost of the job. The wood polisher must emphasise that this cost is an estimate and that the actual may vary by 5 to 10% depending on the actual material consumed and man hours spent.



Fig 2.1.6: Colour panel for customers to choose from (craftsmensupply.com)

2.1.7 Job Area Calculations

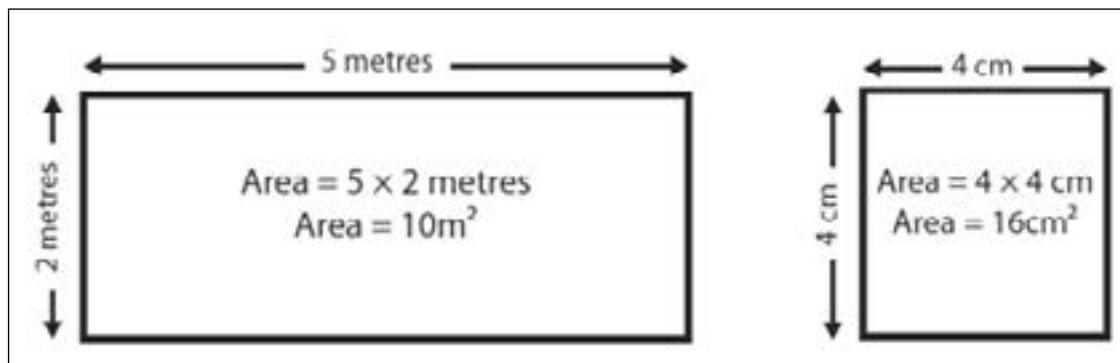


Fig 2.1.7 (i): Area of square and rectangle = length X breadth

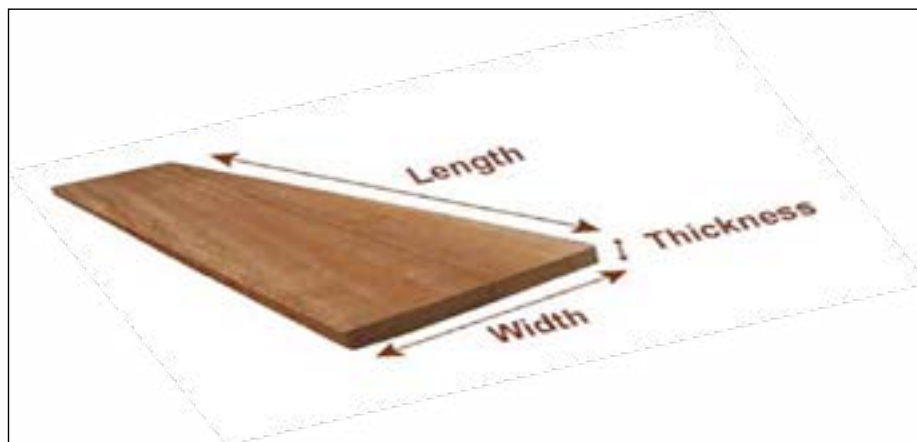


Fig 2.1.7 (ii): Rectangular plank measurement (woodworkerssource.com)

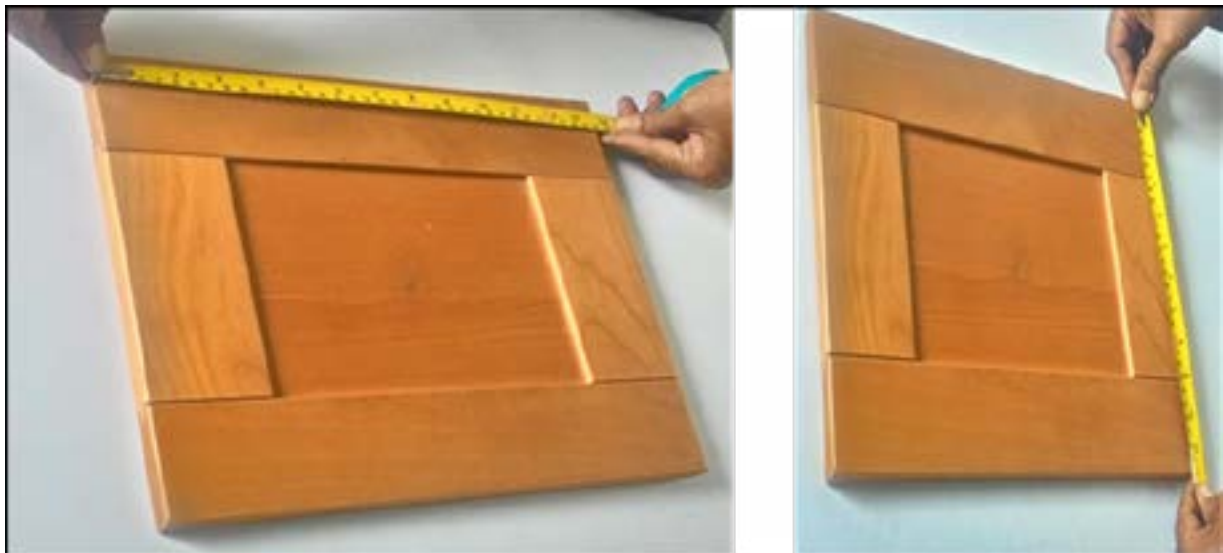


Fig 2.1.7 (iii): Measuring area of a square/rectangular surface

Area of cylindrical surface = $2 \times \pi \times r \times h$

Area of circle = πr^2

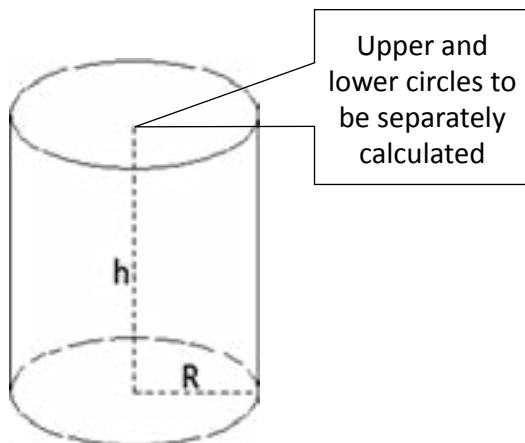


Fig 2.1.7 (iv): Measuring area of a square

Fig 2.1.7 (v): Measuring area of a circular surface/rectangular surface

$$\text{Triangle} = \frac{\text{base length} \times \text{height}}{2}$$

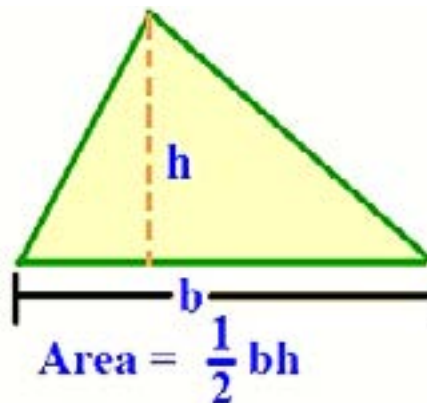


Fig 2.1.7 (vi): Measuring area of a triangular surface



Fig 2.1.7 (vii): Lipping, mouldings and edges to be measured in length, running feet



Fig 2.1.7 (viii): Must have marking and measuring tools (woodmagazine.com)

EXAMPLE OF A MEASUREMENT SHEET

#	Description	Nos.	Length (feet)	Height (ft.)	Area (Sq. ft.)	Running ft.	Net Quantity
1							
2							

2.1.8 Estimate for Time, Cost, Material/Supplies and Equipment

It is important to check the wood quality and carpentry workmanship for scratches and cracks, dents, joinery, knots, nailing holes and quality of gluing. The type of wood or veneer or MDF used for the furniture should be ascertained. It is important to check the moisture content by light sanding or using a moisture meter, if the work is new. The surface must be free from oil, grease or any other contamination or any damage. The time required for surface preparation and taping / masking, hole / crack filling, sanding should be estimated. This is important to assess the total work load, and the time needed to complete the entire task.

The areas to be painted and polished should be calculated separately. Estimation should be made separately for solid colours and clear coats by taking actual measurements and converting them in square feet area for flat surface and running length for borders / lipping / moulding etc. The site condition should be inspected to see if the work is completely new or reworking is required. Following are some important points to consider:

As per area to be finished, the material requirement is to be calculated. Initially, it can be based on the guideline provided in this handbook, and then adjustments can be made based on experience. An overestimate may lead to a higher quote resulting in loss of the business. A lower estimate will lead to incurring losses on the job. Hence it is important to make correct estimates and recheck all calculations. A list of material and equipment required on site, including the transport cost should also be made.

It is also important to estimate the total time required to finish the work. Status of prior jobs, like carpentry, electrical, POP, etc and their completion schedules should be ascertained. One must be prepared for doing certain jobs in parallel with the other agencies. Considering all these factors the time frame to complete the work order must be estimated with adequate safety margin. Often tasks such as painting and polishing which come at the end invariably get squeezed for time to make up for delay in earlier activities. It is important to reiterate to the customer the time required *after* the job ready in all respects is handed over for polishing. As the surface changes, tools and coating material changes. e.g. solid wood and veneer need transparent sealer while for MDF coloured primer is used. For raw sanding and sealer sanding, polish papers of different grits are used.

The table below gives some indication of the wood preparation and coating products.

MATERIAL	DESCRIPTION
SAND PAPERS	80, 120, 150, 220, 320, 400, 600, 1000, 1500, 2000
PUTTY COLOURS	White, light walnut, dark walnut, rosewood, teak, wenge, rubber wood etc.
SEALERS / PRIMER	NC, melamine, PU white primer,
MATT TOP COAT	NC, melamine, PU, water-based PU
GLOSSY TOP COAT	Melamine, PU, polyester

2.1.9 Payment Schedule

Once the total cost of the payment for the customer is agreed upon, the painter must discuss the payment schedule in very clear terms. The payment schedule may look something like this:

- Advance for material etc.: 40%
- On completion of 50% of the work: 20%
- On completion of 80% of the work: 20%
- On completion of 100% of the work and exiting the premises: 20%

Of course, this may vary but the idea is that it must be clearly scheduled and agreed upon. It is advisable that this payment schedule is written down and both the customer and the painter sign and retain a copy each.

NOTE: It is the responsibility of the painter to protect the customer's assets and properties during painting. The painter must use masking tape to protect surfaces that should not be painted. Paper must be spread on the floor to collect dust and paint spills while sanding and painting. Extreme care must be taken to protect the customer's assets. It may be advisable to request the customer himself/ themselves to shift high value items from the painting area prior to painting.

Notes



UNIT 2.2 Conduct and Communication During Wood Polishing

Unit Objectives

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

1. Manage customer interaction in the course of the job and ensure effective execution

2.2.1 Conduct and Communication During Wood Polishing

Once the job is awarded and work starts, you will be at the site continuously till the job is completed. During this phase you must conduct yourself with utmost responsibility in the customer's premises. The following is an indicative list of do's and don'ts that would help manage smooth execution of the job.

DO	DONT
Speak politely and respectfully to all the people in the customer's premises always	Do not raise your voice or speak loudly
Make sure your personal hygiene is of acceptable standards – take bath and wear clean clothes every day	Do not use your mobile telephone and carry on conversations of a personal or frivolous nature
Make sure the area of work and tools are cleaned thoroughly and stored neatly before leaving the premises for the day	Do not smoke or chew paan inside the premises
Every day inform the customer of your work plan for the next day. This will help the customer to keep the area free for painting	Do not take photographs of any part of the house without obtaining the permission of the customer
Please knock at the door and enter only when permitted to enter any room	Do not use the customer's toilets or sleep in the premises without their express permission
If carrying your food, please ask the customer to indicate where you can have your food within the premises. Please be careful that the food you carry is appropriate and not offensive to the customer	Do not use obscene or vulgar words/expressions with your colleagues or anyone else in the premises

Notes

UNIT 2.3 Conduct and Communication After Completing the Job

Unit Objectives

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

1. Enumerate tasks to be carried out on completion of the job and to ensure full customer satisfaction
 - The painter must engage sufficient manpower to clean all the painted areas of spillages and any other stains or rubbish. This must be thorough. All the masking tapes, papers on the floor, etc. must be removed and put in the dustbin.
 - All the furniture and other items that were moved during painting must be restored to their respective places with the guidance of the customer.
 - If the material belongs to the customer, all material such as brushes, rollers, etc. must be cleaned and returned to the customer. Paints or accessories remaining must all be packed properly and handed over to the customer.
 - The painter should ask the customer to settle all pending payments and give a receipt, where applicable and necessary.
 - Leave contact particulars for the customer to reach out if needed or in case of any complaint.

The most important thing is to thank the customer sincerely and ask to be called should there be any problem or requirement. A clean and gracious exit enhances the customer experience and gives them confidence of after sales service.

Tips

A proper match between customer expectation and our offering is essential to the overall success of the job.

Scan the QR code for video



**PAINTS AND
COATINGS
SKILL COUNCIL**



3. Surface Preparation and Coating

- Unit 3.1 - Wood Polishing Sequence
- Unit 3.2 - Sanding
- Unit 3.3 - Wood Fillers / Putty
- Unit 3.4 - Wood Coating Application Methods
- Unit 3.5 - Paint Circulation System
- Unit 3.6 - Spray Application
- Unit 3.7 - Finishing Process
- Unit 3.8 - Drying of Different Paint and Coating Systems
- Unit 3.9 - Cleaning After Application

Scan the QR code for video



Key Learning Outcomes

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

1. List various steps in the finishing of wood and explain each stage
2. Describe correct and incorrect ways of doing the job
3. Select the right process and materials to suit the job
4. Execute a polishing job well from start to finish

UNIT 3.1 Wood Polishing Sequence

Unit Objectives



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

1. Enumerate the steps in a wood finishing job and their sequence
2. Express clearly what the expected outcome of each step is

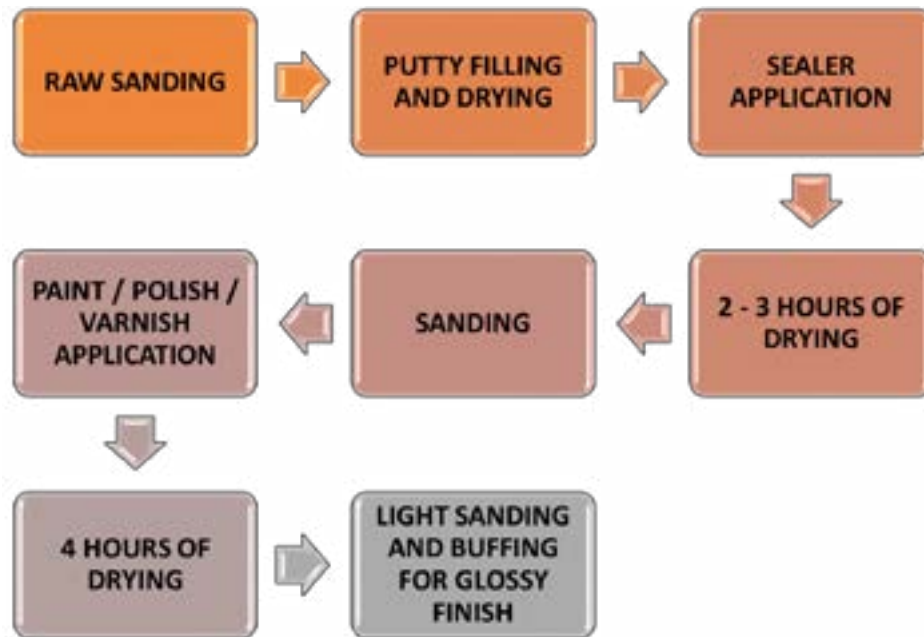


Fig 3.1 (i): Typical sequence for wood polishing

1. Cleaning is the first and most important step in wood finishing. Without proper cleaning it is not possible to get good adhesion and finish.
2. If wood is raw, direct sanding is possible. From previously painted or polished wood, the coating should be removed by sanding or by application of paint remover. After complete removal of the coating, the wooden surface can be sanded for subsequent operations.
3. Wood filler/putty can be used to fill holes, dents, knots and joinery and to hide the surface imperfections. Often, carpenters fill holes using water-based glue with fine saw dust. This is not a good practice and the coating will not give satisfactory results.
4. Sanding of dry filled surface is difficult.
5. In one wooden panel there could 2- 3 or more colours in wood grain pattern. Putty/ filler in different colours can be made matching the base colour. Further colour matching can thus be avoided saving time and obtaining a natural look.
6. After complete drying of the wood filler / putty filling the surface may be sanded.
7. For solid harder wood like teak, sanding can be done with 80-120-220 grit sand paper in the given sequence. For soft wood like Pine the sanding can start with 150 grit sand paper and finish with 220 grit sand paper.
8. For veneer, sanding may be done with 150 or 220 grit sand paper. Heavy pressure is to be avoided as the veneer is thin and the wood grain structure may get destroyed.

9. After sanding, saw dust must be removed properly from the surface with dry brush or soft cotton rag. Otherwise the dust will interfere with further finishing.
10. Masking the surrounding surfaces or non-polishing area is very important. While spray polishing /painting, the unwanted area will get sprayed if not masked.
11. Solid colour painting, needs pigmented primer which may be white, black, grey or any other tinted colour. 2 to 3 coats of primer may be required for good quality of finishing. After each coat of primer, intermediate sanding is required after complete drying.
12. For solid wood and veneer, it is necessary to apply clear sanding sealer.



Fig 3.1 (ii): Surface preparation tools (popularwoodworking.com)

Notes



UNIT 3.2 Sanding

Unit Objectives



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

1. Explain what sanding is and why it is important
2. List different kinds of sandpapers
3. List different methods of wood sanding
4. Understand proper technique of wood sanding

For sanding of raw wood, veneer or MDF, open coat aluminum oxide papers available in various grades (80, 120, 150, 220, 320 grit) are suitable. In our market these are known as “*sukha-paper*” or dry lube paper and are easily available in shops selling paints.

For sealer sanding, non-loading paper, also known as anti-clogging paper or stearated paper is suitable. These papers last longer as they do not get clogged by powder / dust generated while sanding.

Very smooth and hard surfaces such as pre-laminated boards must be sanded using 120 or 150 grit paper to achieve the desired roughness for good adhesion. For sealer sanding, use of 1000 grit or higher - extra fine paper may result in improper top coat adhesion.

3.2.1 Raw Wood Sanding

Proper sanding at all stages of wood finishing is important for getting good results. The selection of sand paper grit depends on the wood type - soft or hard, MDF, veneer etc. Deep sanding marks result from selecting wrong grit size paper and they will be more visible on a clear finish than a pigmented one. The number on the sand paper, belt sander or disc sander is the grit number. The number may be same, but coarseness can be different to a small extent. Coarseness may vary slightly when products of different manufacturers are compared. Polisher should check the coarseness by hand and use as per experience with proper understanding and skill.



Fig 3.2.1: Visual difference between sanded and un-sanded components (confessionsofaserialdiye.com)

Courser grits (60-80) are generally used for hardwood species and finer grit (220-320) for softer wood species. 180 grit paper is considered average grit, commonly used for medium hardness of wood e.g. for teak wood (Hard) 120 -150 grit is used for final smooth raw sanding. As a general rule, it is advisable to use as fine a grit as possible. Deep scratches would be created if a coarser grit paper is used, resulting in uneven stain penetration and dark and light patches.

While sanding, the sandpaper needs to be constantly changed, as the grains break down and the space between the grit particles gets loaded / clogged with sawdust. The abrasive power progressively comes down and the paper efficiency reduces. Due to improper sanding, uneven stain absorption can be observed, and it will clearly be visible after final finish. It would be difficult to repair this unevenness.

Machine tool / power tool marks and burn marks are frequently observed on finished wooden surfaces. These marks must be sanded fully till they vanish. Polishers believe that sanding with super fine grit will achieve a better finish. This is not always true. The main purpose of sanding is to remove mill marks, tool marks, minor defects completely and to smoothen the surface. While sanding, sandpaper leaves small grooves / scratch-lines depending on the sand paper grit size selected. Sanding with progressively finer grits will make these grooves finer. Once the grooves reach a stage where they are no more visible to the naked eye, no further sanding is necessary. With proper practice, and understanding, a polisher will learn this skill. While progressively sanding the surface, one should select a sand paper grit number that is just fine enough to remove the grooves of the earlier sand paper. Use of 80 - 100 grit sand paper to remove milling marks and any other surface defects followed by 120 - 150 sand paper to minimise the grooves and finally finishing with 180-220 grit sand paper is a suggested sequence for most situations. With proper practice and understanding one can learn and fine tune this skill.

3.2.2 Sanding Techniques

Manual sanding: While hand sanding, it is important to use the right pressure. Excessive pressure can clog the paper or cause the paper to wear out too fast and result in an uneven surface. The effect of uneven pressure is significant for all grit sizes. Sand scratches would absorb more stains and lead to uneven colour patches. Practice and understanding will help improve the skill over time.



Fig 3.2.2 (i): Manual sanding (bobvila.com)

Power sanding: Power sanding requires very little pressure, just guiding the tool on the surface is normally sufficient. In both, manual and power sanding, the sandpaper should be moved along the grain of bare timber, not across (see the figure below). On a smooth, non-grained surface, the

sandpaper is moved in small circular motions. A good finishing job requires sanding the entire surface evenly without missing any spot. A common mistake seen is sanding the flat surface neglecting the edges. This creates a dished surface with high spots around the edges.



Fig 3.2.2 (ii): Power sanding

3.2.3 Sanding Direction



Fig 3.2.3 (i): Sanding directions

Power sanders, such as palm sanders and orbital sanders, will cut through rough wood and old finishes quickly but may leave swirl marks in the wood. These swirl grooves will be highlighted when a stain is applied. Any vibrating sander will leave these grooves on the surface. No matter which type of power sander is used, a final sanding will need to be done manually. Sanding wood with power sanders alone cannot provide the required finish.

A sanding block and paper will work well for larger flat areas, but contoured surfaces will need different techniques. Most types of wood trim have contoured profiles that can't be sanded with a stiff square block. Fortunately, this is easily taken care of with a sanding sponge or a small piece of sand paper wrapped around finger while sanding in contoured areas. The sponges work great and are available in variety of grits.



Fig 3.2.3 (ii): Sanding block

3.2.4 Folding the Sand Paper



Fig 3.2.4: Correct and incorrect ways of sandpaper folding (instructables.com)

A trick used by professional painters is to fold the sand paper into thirds. This will provide three sanding surfaces ready to be used. When one side becomes worn or overloaded it is simply refolded with a new sanding surface showing. When sanding by hand on flat surface, use of a sanding block will help to evenly spread out the pressure over a large area and speed up the work. The block also prevents excessive sanding of a small area creating depression in the wood surface.

3.2.5 Removing Sawdust

Sanding generates fine saw dust and grits which get deposited on the work piece. This should be removed from time to time by blowing compressed air or by dry brushing or wiping with a cloth.

Important Tips

1. Always refold or shift the sandpaper often to expose fresh sanding surface. While sanding, vacuum clean or brush away the dust from the wood surface from time to time. This will prevent the dust from clogging the sandpaper grits. Clean the sand paper frequently. Before continuing with the next finer grit, do not forget to clean the surface. This will remove the loose dust from the previous sanding.
2. Sand along the wood grain and never against it. Use long even strokes with little overlapping on the earlier sanded stroke.
3. When the sandpaper is no longer cutting the surface effectively, discard it and get a new piece.
4. Types of sand papers.
5. Open coat grit sand paper: It has grit covering only 50-70% of the paper surface. And there is enough space between the grits which acts as space / gullet between the teeth. Due to this space between the grits, paper will not get clogged easily, and the paper would work longer.
6. Close coat grit sand paper: It has grit covering entire surface with no space / gullet between grits. This paper will get clogged easily, and the paper would not work longer.

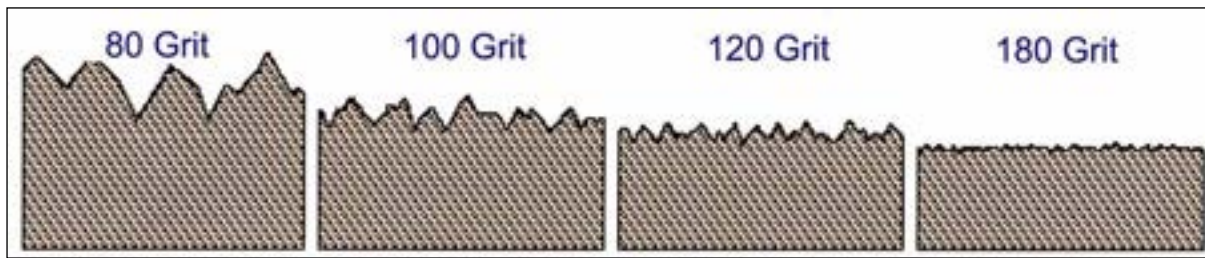


Fig 3.2.5: Types of sand papers (generalfinishes.com)

Abrasive grains on the sand paper are friable or semi-friable; meaning they break down / get fragmented to expose fresh cutting edges as the sandpaper wears. This friability rejuvenates the points, so it extends the life of the sandpaper. It also produces a more consistent scratch pattern than a nonfriable material.

3.2.6 Different Types of Abrasives Used in Woodworking



Fig 3.2.6 (i): Aluminium oxide sand paper



Fig 3.2.6 (ii): Abrasive pads



Fig 3.2.6 (iii): Silicon carbide

Aluminium oxide is one of the most common woodworking abrasive papers. It exhibits a high degree of friability. This means that when sanding pressure is applied, with the generated heat the grit fragments. This is desirable because when aluminium oxide fragments it creates new sharp edges. This self-renewing property allows aluminium oxide to last longer than most other sandpapers. This type of sand paper is widely used and is better for raw sanding as well as sealer / lacquer sanding.

Abrasive pads are made from a 3D open structure of nylon / PP type non-woven material impregnated with abrasive grains, usually aluminium oxide held together by resin to form a loose webbing.

They are available in various forms such as rolls, hand pads, belts and wheels etc. They have colour codes which are used to indicate fineness of grit - green is coarser and grey is the finest.

Silicon carbide is harder than both the above i.e. Aluminium Oxide and Garnet. This makes it suitable for cutting even harder materials such as metal, plastic and fibreglass, and so these are used more widely in this industry than wood working industry.

In wood working industry, silicon carbide is the best to sand previously coated surfaces previously coated with hard coatings such as Melamine, PU, UV cured coatings. This sand paper is best used with water as a lubricant, so good for wet sanding. It is not very suitable for raw wood sanding.



Fig 3.2.6 (iv): Ceramic



Fig 3.2.6 (v): Stearated paper



Fig 3.2.6 (vi): Wet & dry sand paper

Ceramic is not a friable material. It is the hardest of all of the abrasives commonly available. It is generally available in only the coarser grades for faster raw wood sanding as well as old coating removal in woodworking industry. The most common use for ceramic sandpaper is shaping and levelling of wood. It is also expensive sand paper.

Stearated paper is zinc stearate layer added on paper. This paper gives good lubrication to remove the saw dust and swarf from the paper abrasive grit. Stearated papers are commonly used for sealer and lacquer sanding.

Wet and dry sand paper: While sanding with this paper water is used as lubricant. These sand papers are made from silicon carbide grit, which is tougher and used for sanding hard finishes.

There are other types of sand papers too available in the market. Typically, they will have one of the above basic abrasive grit with a special treatment done on the surface to add some feature for better value from the process convenience.

GRADE	COLOUR
EXTRA COARSE	GREEN
COARSE	BROWN
MEDIUM	MAROON
FINE	BLUE
VERY FINE	GREY

Fig 3.2.6 (vii): Colour coding for abrasive pads



Fig 3.2.6 (viii): Abrasive sponge/foam pads

Foam sanding pad: The foam sanding pad is manufactured from high quality soft foam, giving a totally flexible non-cracking multi-purpose pad. The pad is available in silicon carbide or aluminium oxide grits of various grades. It can be used wet or dry and has a much longer life than conventional sandpaper. Another advantage is the flexibility it offers, to reach the moulding inside curvatures.

Screen metal disc sander: This is a revolutionary new technique for dust-free sanding. This unique sanding material is a metal net, which contains thousands of small openings, making it possible to effectively vacuum away dust without clogging the disc. It gives a very uniform sanding and smoother surface since the amount of airborne dust is sucked and sent to the dust collector. These metal discs are available in various coarseness to smoothness levels.



Fig 3.2.6 (i): Screen metal mesh disc



Fig 3.2.6 (i): Screen metal mesh disc

[illegible]

UNIT 3.3 Wood Fillers / Putty

Unit Objectives



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

1. Describe different kinds of wood fillers / putty
2. List the uses of fillers
3. Describe the process of putty application and preparation
4. List the reasons for staining of wood

3.3.1 Wood Fillers and Putty

Commonly used wood fillers are described in the table below.

#	FILLER	DESCRIPTION
1	RAW SIENNA	It is a clay which, in its natural state is ochre yellow in colour. It has excellent hiding, non-fading and exterior durability properties.
2	BURNT SIENNA	It is a clay which in its natural state is yellow-brown or reddish brown in colour. It has excellent hiding, non-fading and exterior durability properties.
3	TURKEY AMBER	It is a clay which in its natural state is blackish brown-red colour. It has excellent hiding non-fading and exterior durability properties.
4	CARBON BLACK	Carbon black is furnace black, lamp black and thermal black. It is a material produced by the incomplete combustion of heavy petroleum products.
5	WHITE ZINC OXIDE	Zinc oxide is an inorganic pigment. It is a white powder that is used for tinting of colours like pink, off-white etc. It is used more particularly in whitish wood e.g. pine, oak etc.
6	WHITING CHALK POWDER	It is a white powder which when mixed in melamine, NC or PU coatings gives almost transparent film after drying. It is also known as extender.



Fig 3.3.1 (i): Raw sienna (indiamart.com), burnt sienna (indiamart.com) and turkey amber



Fig 3.3.1 (ii): Carbon black (rasayantrading.com), white zinc oxide (purenature.co.nz) and white chalking powder(ebay.co.uk)

All the above types of powders are used after inter-mixing and mixing with French polish or lacquers for colour matching on veneer, wood etc. These powders are used for staining purpose as well as in putty making.




	STEP 1: Mixing of powder and stain.
	STEP 2: Prepared putty.
	STEP 3: Application of putty.

Fig 3.3.1 (iii): Stages of wood putty preparation (woodworkersjournal.com, heinrichkoenig.de & thespruce.com)

Note: No thinner should be added to the putty.

3.3.2 Staining Wood

This is the process whereby architectural wood surfaces can be made more attractive because their appearance is changed and enhanced. The purpose of staining may be to bring definition to the wood grain, to match the appearance of a different species of wood, to unite other surfaces or to compliment other architectural features. By using wood stain ordinary wood species can be made to look such as expensive wood like walnut or rose wood. Also, even if you take the same wood type, many a times there is a colour difference in joinery. This can be matched to the darker shades by using stains.

Stain is composed of the same three primary ingredients as paint (pigment, solvent (or vehicle), and binder). Much like the dyeing or staining of fabric, wood stain is designed to add colour to the substrate (wood and other materials) while leaving some of the substrate still visible.

Applying stains can be very easy or very difficult depending on the type of substrate, type of stain, and the ambient conditions. Stains can be applied by brush, rag and spray – each varying in finish and requiring varying levels of skill, time and effort.

A variety of colour patterns can be generated as shown in the figure.



Fig 3.3.2: Wood stains (venezdecouvrir.com)

3.3.3 Types of Wood Stains

Pigment based stains: Pigmented stains deposit pigment between the fibres and into the pores of wood. These stains are stable and are most often recommended for architectural and outdoor application. Pigment stains are available in liquid or gel forms. Generally, the quality of stain application is judged by the following factors:

1. Stability of the colour
2. Uniformity of appearance

A pigment stain contains a binder and does not penetrate the wood. It lodges in pores, scratches and defects and gives the surface an opaque colour. It is generally resistant to fading and solvents.

Dye based stains: Dye stains actually dye the fibre of wood. They are transparent in nature and beautify the natural texture of the wood to a great extent. Dye stains such as aniline dye stains allow more “depth” to a finish and are often used for fine furniture. They are, however, photosensitive and will fade with exposure to light.

Dye stains can be difficult to apply. They are usually best applied by spray, brush or cotton rag by an experienced applicator. Extreme caution should be used to achieve an even application. While using these stains with cotton rag or brush, if the hand movement stops or overlaps, the colour depth would be darker. Dye stains are very difficult to remove from wood and subsequent applications will change the colour. Dye stains are made from 6 base colours. An infinite array of colours can be produced by inter mixing the dyes. Adding suitable solvent can reduce intensity and depth of the colour. They soak wood surface, may be water soluble or solvent soluble and result in giving the surface a bright colour.

- Dyes are transparent colourants
- They are soluble and are dissolved in solvent or water
- They are less resistant to fading as compared to pigment-based stains
- They impart bright colours to the surface
- Colour matching is easy

3.3.4 Other Stains in the Market

1. Oil stains - Stains containing pigments or dyes with oil as binder.
2. Water based stains - Pigments, dyes, or both with any water-based binder.
3. Lacquer stains - Stains containing pigment, dyes or both with fast drying binder or NC lacquer.
4. Gel stains - Contain only pigments with thick resin. Stain does not run down but stays on the wood surface.
5. Non-grain raising stains – Water based stains tend to raise the wood’s grain. However, there are methanol-based dyes offered as wood stains which overcome the problem of raising the wood’s grain.

Exterior stains: Exterior stains are used primarily on wooden decks and outdoor structures, and furniture. They are available in latex-and oil-based formulae. Oil-based semi-transparent stains offer the best protection of wood fully exposed to weather; they can also be used on new or weathered wood, or wood previously finished with other penetrating finishes, without extensive surface preparation. If a solid colour is desired, latex opaque stains are preferable to oil-based opaque stains, since they are more flexible, have better colour retention, and are less prone to mildew. However, extensive surface preparation is required for proper adhesion, and latex stains in general should not be used on structures exposed to direct sunlight. Wood stains commonly available in market are teak, dark walnut / light walnut, rosewood, black, orange and wenge.



Fig 3.3.4 (i): Wood stain effect (apieceofrainbow.com)



Fig 3.3.4 (ii): Wood staining in progress (finewoodworking.com)

Notes



UNIT 3.4 Wood Coating Application Methods

Unit Objectives



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

1. List the different kinds of application tools
2. Explain the advantages and disadvantages of each tool
3. Explain salient features for each tool

3.4.1 Wood Coating by Brush

1. A varnish brush is designed and constructed to evenly flow on thin finishes such as oil-based polyurethane, shellac and lacquer; paint brushes are designed to apply much thicker material.
2. A sash brush is a round, tapered natural bristle brush that is uniquely suited for evenly applying finishes to uneven surfaces such as shaped mouldings or carvings.
3. A synthetic bristle brush has nylon bristles and is an excellent choice for water-based materials.
4. Disposable brushes are the best to work with, however, shellac and lacquer will dissolve them.



Fig 3.4.1: Variety of brushes for wood coating (popularwoodworking.com)

ADVANTAGES	DISADVANTAGES
Applicable to medium viscosity paints and low volumes	Compared to other application techniques like spray, brush application is slower
Very little quantity of thinner is required to adjust for application viscosity	Difficult to maintain consistency of film thickness
Corners and crevices are easy to access with help of various sizes of brushes	Due to continuous movement of hand, operator gets tired soon and work efficiency gets reduced.

Brushes are very cheap compared to other application equipment	Speed of painting is generally defined by the applicator i.e. the painting solely depends on operator's efficiency, skill and willingness to complete the job
	Since painting with brush is a slow process, the operator remains in contact with hazardous solvent vapours for longer time if proper ventilation is not available
	Not suitable for high solids and low pot life paints

3.4.2 Wood Coating by Roller

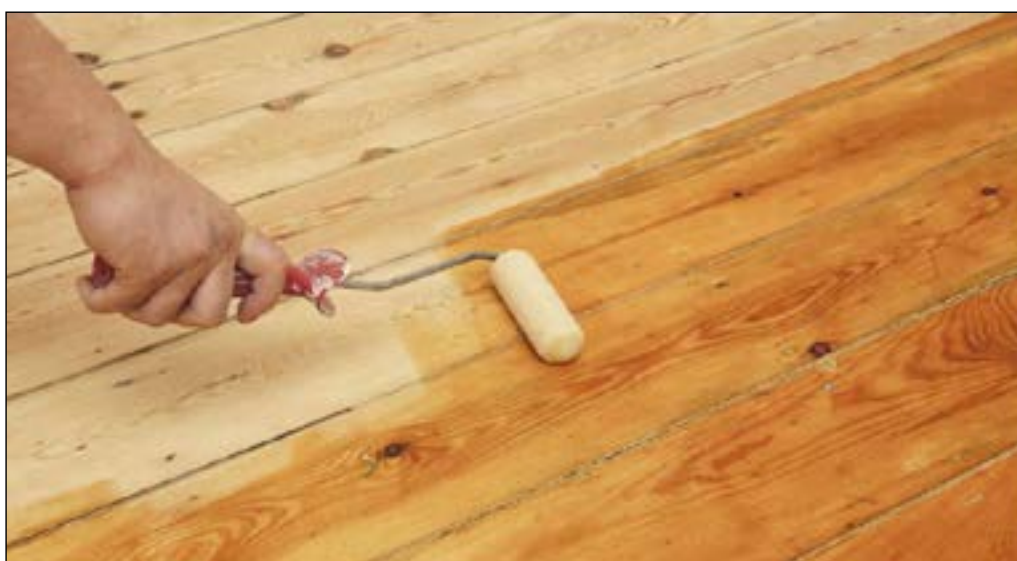


Fig 3.4.2: Wood coating by roller (klindex-wood.com)

ADVANTAGES	DISADVANTAGES
3-4 times faster than brush	Compared to other application like spray, roller application is slower
Suitable for low viscosities	Due to continuous movement of hand, operator gets tired soon and his work efficiency gets reduced.
Finish is superior to brush finish	Speed of painting is generally defined by the applicator i.e. the painting solely depends on operator's efficiency, skill and willingness to complete the job
Roller application by hand is cheaper compared to spray application equipment	As with brush application, the operator remains in contact with hazardous solvent vapours for long
	Not suitable for high solids and low pot life paints
	Cannot be used on all profiles

UNIT 3.5 Paint Circulation System

Unit Objectives



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

1. State what a paint circulation system is and how it functions

Large furniture manufacturers have set up for paint mixing and application similar to that being used in automotive painting units. The system consists of a paint kitchen where the supplied paint / varnish is adjusted to the application viscosity and supplied to the spray booth through circulation lines.

The unused paint in the circulation line returns to the supply tank in the paint kitchen. The recommended filters for the various paint types in a circulation line are as below.

PAINT TYPE	FILTER SIZE
PRIMER	50μ / 75μ
SOLID MONO COAT	25μ
CLEAR	10μ / 25μ



Fig 3.5: Paint circulation system (bm-systems.com)

UNIT 3.6 Spray Application

Unit Objectives



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

1. List the advantages and disadvantages of spray application
2. Explain the different kinds of spray applications

For spray application, usually compressed air is required for atomising (forming fine droplets) of the polish/ paint/ varnish. Types of spray application methods are:

- Air spray or air assisted spray / conventional spray
- HVLP (High Volume Low Pressure) spray
- Airless spray
- Air-assisted airless spray
- Electrostatic spray
- Electrostatic air spray
- Electrostatic air assisted spray



Fig 3.6 (i): A large table being sprayed (polistuc.ro)



Fig 3.6 (ii): A cabinet and wooden flooring being sprayed (familyhandyman.com, dreamstime.com)

3.6.1 Air Spray Technology

This is most widely used spray method world over. The paint particles are broken into tiny droplets (atomised) with the help of the high energy of compressed air and the paint flows out of the fluid nozzle. This is a simple on and off mechanism, in which the fluid passage is opened when the needle is pulled backwards. The needle is attached to the trigger and as the trigger is pulled back the fluid needle gets pulled and the gap between the nozzle inside wall and needle opens to let the fluid flow out. The pressure on the trigger will determine the extent of the gap available for the fluid to flow out and thus the amount of paint coming out of the gun can be controlled.

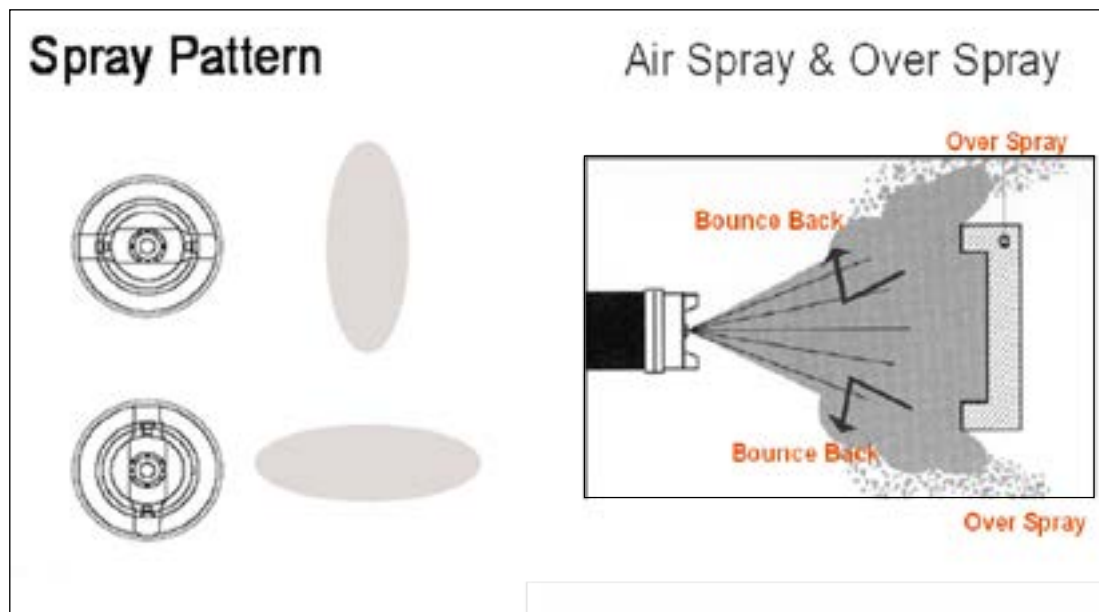


Fig 3.6.1 (i): Spray pattern and air spray with over spray



Fig 3.6.1 (ii): Air spray technology (graco.com, kraska.guru)

ADVANTAGES	DISADVANTAGES
This spray process offers the most controllable degree of atomisation. It is the right choice for getting the best quality finish possible	Conventional air spray has extremely low level of transfer efficiency. Often, more material is wasted than is actually deposited on the job.
A trained operator, can control the spray pattern from spraying of small or large areas without changing guns or nozzles.	This condition is usually aggravated by excessive pressure and poor operator technique. Air spray also consumes large amounts of compressed air (7-15 cfm at 100 psi).
This process gives the operator the ability to spray the widest range of coating materials. It is also the easiest system to operate and maintain	
The equipment available is the cheapest among all the spray processes	

3.6.2 High Volume Low Pressure Spray

This type uses a turbine to produce the low air pressure and high volume, which directly feeds to the spray gun. A spray gun should operate at air pressures between 06-16 psi (at the air cap) and consume air volumes of 15-30 CFM to be considered a true HVLP spray gun. Although some HVLP guns with internal restrictors can exceed 16-psi air pressure, it is up to the operator to follow local regulations when necessary.

Notes





Fig 3.6.2: HVLP spray gun and application with it (sata.com, house-painting-info.com)

ADVANTAGES	DISADVANTAGES
HVLP spray gun is well suited for wood stain application as the stain reaches the corners easily due to low air pressure	The most notable limitation of the HVLP process is that the finish quality from some HVLP spray guns is not as good as conventional air spray but for matt finish it is at acceptable level
The benefits of HVLP atomisation are improved transfer efficiency, often approaching 40-60% or more; compliance with local regulations; a softer spray that penetrates easily into recess or cavities; reduced material consumption; reduced spray booth maintenance and reduced hazardous waste	This may necessitate additional polishing or a change in the material formulation for improving the finish
Turbine-operated HVLP systems enjoy great portability and ease of operation where compressed air is not available. HVLP spray guns with internal restrictors use existing air supplies, are easy to operate, and are low in cost	Cost of the HVLP gun is higher than Conventional Air Spray units. Turbine-generated HVLP systems may be expensive to purchase and to operate
	HVLP guns using internal restrictors must have an adequate supply of clean and dry air to operate efficiently
	Turbine guns use a larger air hose, which may be difficult to work with

3.6.3 Transfer Efficiency

Transfer efficiency is the ratio of the amount of paint that gets deposited on the surface to be coated to the total amount of the paint sprayed. It is thus the % of paint sprayed that deposits on the sprayed part. Transfer efficiency is important because it measures the coating actually used. Overspray could go everywhere, except on the job.



Fig 3.6.3: Transfer efficiency (graco.com)

3.6.4 Air Assisted Airless Atomisation

Air assisted airless spray was developed to fill a need that resulted from escalated material costs and newly enacted Environmental Protection Agency (EPA) regulations. Air assisted airless, under ideal conditions, combines the best features of air spray along with the best of airless. Air assisted airless spray guns first partially atomise the fluid with a special fluid nozzle tip similar to a standard airless tip. Second, they complete the atomisation with small amounts of compressed air from the face and/or the horns of the air nozzle that they use. The result is a finely atomised spray pattern closely resembling that of a compressed air system. Newly designed low pressure, air assisted airless systems are also available. Some systems restrict the atomising air pressure to comply with various EPA guidelines; as a result, these systems can be considered HVLP Air assisted airless.

ADVANTAGES	DISADVANTAGES
The primary advantage of Air assisted airless is its “Soft” spray atomisation	Tip plugging may still be a problem with air-assisted airless
Atomisation air pressures are usually low, and as a result, this system provides a fine finish with most coatings approaching that of compressed air atomisation	Many operators feel that air-assisted airless is too slow when compared to airless and that the finish is still not as good as compressed-air atomisation
With air assisted airless we can see an approximate 30% improvement in transfer efficiency over compressed air	Many operators tend to use excessive fluid and air pressures with this process. There are more controls to learn to use it correctly
This system allows us to increase flow rates, while also spraying into recesses and cavities, without excessive bounce-back of material	
This means less booth maintenance and clean-up time. We also can expect a reduction in compressed-air supply requirements	
Since fluid pressures generally range from 200 to 800 psi, less wear on the pump and tip is to be expected	

3.6.5 Conventional or Atomised Spray

A spray gun uses air at high pressure (40 to 70 pounds per square inch [psi]) to atomise the liquid paint stream. In conventional or air atomised spraying, the coating is supplied to a spray gun by siphon, gravity, or pressure feed. When the gun trigger is pulled, the coating flows through the nozzle as a fluid stream. Compressed air from the center of the nozzle surrounds the fluid with a hollow cone as it leaves the nozzle, breaking the coating into small droplets and transferring velocity to it. Additional jets of compressed air from the nozzle break up the droplets further and form an elliptical pattern.



Fig 3.6.5 (i): Conventional gravity feed spray gun



Fig 3.6.5 (ii): Suction feed spray gun (cup gun)

Cup guns are one of the oldest methods of spraying. Clamped under the cap of the gun, a “cup” is a reservoir of finishing material, stored until it is siphoned up to the tip by compressed air. Vent holes in the top of the cup allow outside air pressure to enter into the cup. Without these vent holes, negative pressure would develop, and spraying would not be possible. The maintenance of these vents is one of the critical features of a cup gun. The compressed air does not enter into the cup and push the material. Rather, it creates a vacuum or siphons the finishing material up through a long suction tube extended to the bottom of the cup. This suction tube must be kept clean. The siphoning action pulls the liquid from the cup where it is mixed with air (atomisation) at the air cap. The benefits of a suction feed gun include quick colour change ability, lower production requirements, and equipment and maintenance costs. The limitations of cup guns are their inability to maintain high production flows and high overspray amounts relative to other spray methods. Because of the high amount of overspray, the transfer efficiency is minimal.



Fig 3.6.5 (iii): Conventional spray

There are many significant differences between gravity and suction fed spray guns. Most notable is how the finishing material arrives at the spray cap. The gravity fed spray gun's material reservoir is connected above the air cap. Instead of air siphoning material from the bottom of a cup, the material

is gravity fed as needed directly to the air cap. The cup is vented, and material storage is limited. The benefits include a finer spray pattern, more material flow and higher production capability than suction feed. The gravity fed system allows the operator to use all the material in the cup with less overspray and compressed air than its siphon fed counterpart. One of the main limitations is its inability to fit into small locations due to the top-mounted cup. A disadvantage of conventional spray is that a high degree of atomisation is accompanied by a very fine spray that is highly susceptible to overspray. The result is more paint waste and low transfer efficiency.

Another method for application of two pack systems is to supply base and hardener, thinned appropriately to achieve the application viscosity after mixing, separately to the tip of the gun. At the tip of the gun, the thinned base and hardener are mixed and then sprayed onto the surface. This type of system does not have a limitation of the pot life.



Fig 3.6.5 (iv): 2 pack system (graco.com)

Tips



- Read the labels on the product containers for mixing ratio of base and hardener. Take specified quantity of base paint in the container and add the hardener in it slowly without foaming. Mix gently. Now for thinning add specified thinner in given ratio and mix uniformly.
- Refer the label / Product Data Sheet (PDS) instructions for mix ratio of sealer / primer/ top coat, component A and component B. Record the pot life for the product at the given ambient temperature mentioned.
- Pot life of the mixed material is the time for which the mixed material is usable without any problem. Generally, the mixed material should be used within 4 hours (recommended time). Never keep for next day use, it will get solid. Even if it does not solidify but gets thicker, discard it since it may not be good for finishing.

- Add the thinner recommended by the paint supplier in accordance with the PDS to adjust the viscosity of mixed primer to the specified level.
- Viscosity of mixed material - The base and hardener start reacting with each other and viscosity starts rising. After some time, it may be too thick to use. Viscosity of any good applying material is normally 18-25 second when measured by flow cup B-4.
- The supply containers containing component A and B shall be kept in a seal tight condition after pouring the contents for each use.
- Record the batch number, manufacturing date, time of mixing, and pot life at the given ambient Temperature and start-finish time of the application.

Notes



UNIT 3.7 Finishing Process

Unit Objectives



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

1. List the step by step process of finishing different substrates

3.7.1 Wood / Veneer Finishing Process



Fig 3.7.1 (i): Putty filling



Fig 3.7.1 (ii): Sanding

STEP 1: Touch up with perfect matching water-based putty in holes, cracks and knots, dents and surface damages and let dry for at least 30 minutes.

STEP 2: Sand with grit 80-100-150-220-320 carefully one after another.



Fig 3.7.1 (iii): Staining

STEP 3: Stain using cotton rag, spray or brush and let dry for at least 30 minutes



Fig 3.7.1 (iv): First coat spraying



Fig 3.7.1 (v): Touch up

STEP 4: First coat sealer application by spray - wet on wet 2 to 3 passes - horizontal and vertical and let dry for 4 hours

STEP 5: Touch up with perfect matching putty in holes, cracks and knots and let dry for up to 30 minutes



Fig 3.7.1 (vi): Electric and manual sanding

STEP 6: Sand using sander 220 grit non-loading sand paper by hand or sanding tool

STEP 7: Clean the surface with air blow or by brush or soft cotton

STEP 8: Second coat sealer application by spray - wet on wet 2 to 3 passes - horizontal and vertical and let dry for up to 3 hours

STEP 9: Touch up with perfect colour matching putty in holes, cracks and knots if required

STEP 10: Sand using sander 320 grit non-loading paper by hand or sanding tool

STEP 11: Clean the surface with air blow or by brush or soft cotton

STEP 12: Stain, if any colour difference by hand or by spray and let dry for up to 3 hours

3.7.2 MDF Painting Process



Fig 3.7.2 (i): Putty filling



Fig 3.7.2 (ii): Edge sanding

STEP 1: Water based putty filling – on scratch and holes and damages and let dry for at least 30 minutes

STEP 2: Edge sanding by 100 - 150 / 220 - 320 Grit sand paper Top or face, bottom sanding by 220-320 Grit sand paper



Fig 3.7.2 (iii): First coat sealer application



Fig 3.7.2 (iv): Touch up with putty

STEP 3: First coat clear sealer/primer – wet on wet 2 cross coats and let dry for up to 3 hours

STEP 4: Touch putty at holes, dents and damages



Fig 3.7.2 (v): Electric and manual sanding

STEP 5: Sanding by sander 220 non-loading paper by hand or sanding tool

STEP 6: Clean the surface with air

STEP 7: Second coat white/black/grey primer – wet on wet 2 cross coats and let dry for up to 3 hours

STEP 8: Sanding by sander 320 grit non-loading sand paper by hand or sanding tool

STEP 9: Clean the surface with air



Fig 3.7.2 (vi): Finish shade application



Fig 3.7.2 (vii): Wet sanding

STEP 10: Apply approved solid colour matt glossy finish shade wet on wet two coats

STEP 11: Sanding by 400, 600 1000 – 1500 and 2000 grit - by waterproof sand paper with water to remove dust from the surface and smooth the painted surface



Fig 3.7.2 (viii): Buffing



Fig 3.7.2 (ix): Polishing

STEP 12: Buffing is done by woollen pad with rubbing compound with 3 to 4 passes with medium pressure. Do not keep buffing pad at one spot while running at high RPM.

STEP 13: Polishing with foam pad by fine cut wax which gives glossy finish.

STEP 14: Clean the buffed surface with micro fibre cloth with little fine cut wax by hand.

UNIT 3.8 Drying of Different Paint and Coating Systems

Unit Objectives



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

1. Explain why drying processes and techniques differ from one paint and coating system to another
2. List the advantages and disadvantages of each system

COATING	DRYING PROCESS	ADVANTAGES	DISADVANTAGES
FRENCH POLISH	Instantly by solvent evaporation	<ul style="list-style-type: none"> • Recoatable within 10 minutes • low cost application 	<ul style="list-style-type: none"> • Poor water, heat, chemical and usage resistance
OILS & VARNISH	Air oxidation in 6 to 24 hours	<ul style="list-style-type: none"> • Economical and simple application 	<ul style="list-style-type: none"> • Attracts dust easily • yellowing tendency
NITROCELLULOSE COATING	<ul style="list-style-type: none"> • Solvent evaporation • Touch dry within 5 minutes • Hard dry within 3 hours 	<ul style="list-style-type: none"> • Moderate water, heat, chemical resistance • Quick drying • faster application 	<ul style="list-style-type: none"> • Poor solvent resistance
ACID CURE OR MELAMINE	<ul style="list-style-type: none"> • Dries due to acidic hardener by chemical reaction • Touch dry within 15 minutes • Hard dry within 4 hours 	<ul style="list-style-type: none"> • Medium water, heat, chemical, solvent and usage resistance • Good adhesion and hardness • Faster application 	<ul style="list-style-type: none"> • Yellowing tendency even by indirect sunlight • Formaldehyde emission for long period
POLYURETHANE	<ul style="list-style-type: none"> • Dries by chemical reaction • Touch dry within 15 minutes • Hard dry within 4 hours 	<ul style="list-style-type: none"> • Excellent water, heat, chemical, solvent and usage resistance • Excellent finish, gloss and gloss retention • Good adhesion and hardness • Faster application • Interior, exterior and flooring grades are available 	

POLYESTER	<ul style="list-style-type: none"> Dries by chemical reaction within 15 minutes 	<ul style="list-style-type: none"> Excellent water, heat, chemical, solvent and usage resistance Excellent finish, gloss and gloss retention Good adhesion and hardness with faster application 	<ul style="list-style-type: none"> Contains hazardous chemicals
ACRYLIC EMULSION	<ul style="list-style-type: none"> Dries by water evaporation Touch dry within 20 minutes Hard dry within 2 hours 	<ul style="list-style-type: none"> Low VOC product (Eco friendly) Medium water, heat, chemical, usage resistance Medium adhesion and hardness with faster application 	<ul style="list-style-type: none"> Low DFT film, need more coats for close pore finishing Finish quality is not similar to solvent based coatings
POLYURETHANE DISPERSION	<ul style="list-style-type: none"> Dries by water evaporation and coalescing process Touch dry within 15 minutes Hard dry within 2 hours 	<ul style="list-style-type: none"> Excellent water, heat, chemical and usage resistance Good adhesion and hardness with faster application Interior, exterior and flooring grades are available 	<ul style="list-style-type: none"> Moderate solvent resistance
2K WATER BASED POLYURETHANE	<ul style="list-style-type: none"> Dries by chemical reaction and also water evaporation Touch dry within 15 minutes Hard dry within 3 hours 	<ul style="list-style-type: none"> Excellent water, heat, chemical and usage resistance Good adhesion and hardness with faster application Interior, exterior and flooring grades are available 	<ul style="list-style-type: none"> Moderate solvent resistance

UV CURABLE COATING	<ul style="list-style-type: none"> • Dries instantly 	<ul style="list-style-type: none"> • Green technology as no VOC, eco-friendly • High productivity, low space required • Excellent water, heat, chemical, solvent and usage resistance • Excellent finish, gloss and gloss retention • Good adhesion and hardness with faster application • Interior and flooring grades are available 	<ul style="list-style-type: none"> • High cost system, limitation for 3 dimensional products curing
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UNIT 3.9 Cleaning After Application

Unit Objectives



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

1. Describe the importance of cleaning and maintenance of equipment for repeat good performance of the piece of equipment

It is very important to clean the spray gun, brush, mixing pots promptly and thoroughly after every use. If mixing pots are not cleaned properly they will contaminate new paint. Spray gun tips and outer body must be cleaned after painting. Once paint/ coating dries in the gun it is very difficult to clean it later. Brush bristles become hard if not cleaned in time.

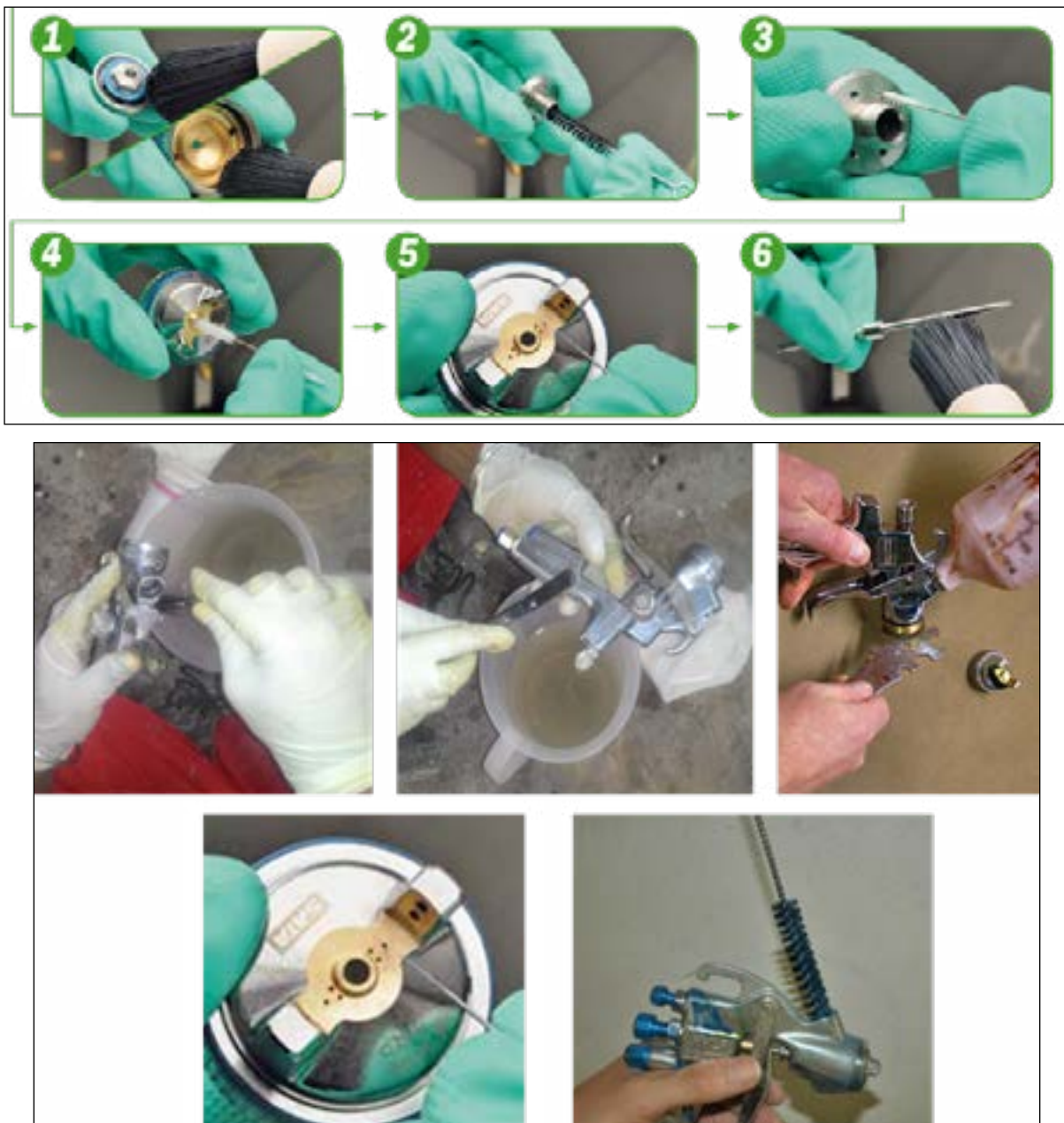


Fig 3.9: Maintenance of equipment and tools

Cleaning of working area is very important at each and every site. It keeps dust away. Items such as used masking tapes / paper, empty containers, pieces of soiled cloth, used polish papers, dust collected at work place and all other refuse should be removed. Cleaned work site adds to work efficiency and finish quality. Safe disposal of waste and residual consumables in designated bins or disposal units is important. Soiled and wet pieces of clothes filled with paint, polish, sealers, stains are to be disposed of properly by collecting in a disposal bag.

Tips



Preparing the surface well, selecting the right finishing materials depending on the wood and service conditions, using the right equipment and following the correct application sequence – all these are important to get a satisfactory quality of finish.

Notes



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**PAINTS AND
COATINGS
SKILL COUNCIL**



4. Conduct Entrepreneurial Activities

- Unit 4.1 - Who is an Entrepreneur?
- Unit 4.2 - Types of Enterprises
- Unit 4.3 - Customer Profile and Marketing
- Unit 4.4 - What is Networking?
- Unit 4.5 - Marketing of Product/Service
- Unit 4.6 - Maintaining Accounts and Complying with Statutory Requirements
- Unit 4.7 - Basic Business Terminology

Scan the QR code for video



Key Learning Outcomes



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

1. Discuss the concept of entrepreneurship
2. Discuss characteristics of an entrepreneur
3. Discuss the different types of enterprises
4. Describe the need and benefits of networking
5. Define some basic accounting terms
6. Paraphrase commonly used business terminology
7. Understand importance of marketing your business

UNIT 4.1 Who is an Entrepreneur?



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

1. Describe who is an entrepreneur
2. Discuss characteristics of an entrepreneur

An entrepreneur is a person who:

- Does not work for an employer
- Runs a small enterprise
- Assumes all the risks and rewards of the enterprise, idea, goods or service
- Has the ability to identify business opportunities

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UNIT 4.2 Types of Enterprises

Unit Objectives



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

1. List different types of enterprises with its characteristics

The following three different types of enterprises can be formed by an entrepreneur.

Sole proprietorship: In a sole proprietorship, a single individual owns, manages and controls the enterprise. This type of business is the easiest to form with respect to legal formalities. The business and the owner have no separate legal existence. All profit belongs to the proprietor, as do all the losses and the liability of the entrepreneur is unlimited.

Partnership: A partnership firm is formed by two or more people. The owners of the enterprise are called partners. A partnership deed must be signed by all the partners. The firm and its partners have no separate legal existence. The profits are shared by the partners. With respect to losses, the liability of the partners is unlimited. A firm has a limited life span and must be dissolved when any one of the partners dies, retires, claims bankruptcy or goes insane.

Limited Liability Partnership (LLP): In a Limited Liability Partnership or LLP, the partners of the firm enjoy perpetual existence as well as the advantage of limited liability. Each partner's liability is limited to their agreed contribution to the LLP. The partnership and its partners have a separate legal existence.

"The entrepreneur always searches for change, responds to it and exploits it as an opportunity."
- Peter Drucker

Notes



UNIT 4.3 Customer Profile and Marketing



Unit Objectives

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

1. List different types of customers

1. List different types of customers

In order to identify business opportunities, the wood polisher should draw up a profile of the probable customers.

The customers can be:

- Individual customers – for example householders who get their furniture painted.
- Corporate or institutional – includes furniture manufacturers, construction companies, etc.

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UNIT 4.4 What is Networking?

Unit Objectives



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

1. Understand concept of networking
2. Describe need to network and list its benefits

In business, networking means leveraging your business and personal connections in order to bring in a regular supply of new business. This marketing method is effective as well as low cost. It is a great way to develop sales opportunities and contacts. Networking can be based on referrals and introductions, or can take place via phone, email, and social and business networking websites.

4.4.1 The Need for Networking

Networking is an essential personal skill for business people, but it is even more important for entrepreneurs. The process of networking has its roots in relationship building. Networking results in greater communication and a stronger presence in the entrepreneurial ecosystem. This helps build strong relationships with other entrepreneurs.

Business networking events held across the globe play a huge role in connecting like-minded entrepreneurs who share the same fundamental beliefs in communication, exchanging ideas and converting ideas into realities. Such networking events also play a crucial role in connecting entrepreneurs with potential investors.

Entrepreneurs may have vastly different experiences and backgrounds but they all have a common goal in mind – they all seek connection, inspiration, advice, opportunities and mentors. Networking offers them a platform to do just that.

4.4.2 Benefits of Networking

Networking offers numerous benefits for entrepreneurs. Some of the major benefits are:

- Getting high quality leads
- Increased business opportunities
- Good source of relevant connections
- Advice from like-minded entrepreneurs
- Gaining visibility and raising one's profile
- Meeting positive and enthusiastic people
- Increased self-confidence
- Satisfaction from helping others
- Building strong and lasting friendships

UNIT 4.5 Marketing of Product/Service

Unit Objectives

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

1. State what marketing is
2. Describe why it is important

Marketing involves offering the product/service required by the customer, that meets or exceeds the customer's expectation, at a price which is affordable, and the customer gets "value for money".

Promotion plays an important role in generating new business. Some key elements of promotion are advertising, public relations, social media marketing, email marketing, search engine marketing, video marketing and more.

Providing good service and completing a job meeting the customer's expectation of quality, cost and time, ensures customer loyalty and also provides word of mouth publicity. This helps in growing the business.

According to most marketers, the basis of marketing is about offering the right product, at the right price, at the right place, at the right time. For this reason, selecting the best possible location is critical for converting prospective clients into actual clients.

To successfully promote their services, entrepreneurs should do the following:

- They should survey the local area for new commercial and residential projects and approach the potential customers through the property developer
- Keep in contact with architects, local carpenters to get polishing / painting jobs
- Keep in touch with paint dealers, wood suppliers, hardware shop owners to get leads to new business and customers
- Put up small boards with name and contact number and leave his visiting card with these people, for prospective customers to contact
- Print and distribute brochures or pamphlets in local area
- Keep abreast of new developments, trends in painting and polishing by:
 - Networking with other painters/polishers, or association of painters/polishers
 - Keeping contact with paint/polish manufacturers' representatives
 - Attending new product launches and/or training program being arranged by paint/polish manufacturers

Notes

UNIT 4.6 Maintaining Accounts and Complying with Statutory Requirements

Unit Objectives



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

1. List accounting related terminology
2. Explain about business related statutory requirements

As an entrepreneur, maintaining daily, weekly or monthly accounts of income and expenditure is required.

As a first step, an estimate or quote needs to be given to the customer for the services being offered. As discussed earlier in this book, the resources required – manpower, materials, tools, etc. need to be estimated and a cost provided for the same, which will be a part of the estimate. A payment schedule is also finalised.

A daily account book should be maintained listing the payment received from the customer as an income and expenses on purchase of material, consumables and daily wages paid to workmen listed as expenditure. This helps in monitoring the expenses and margin for profit. This data is useful for providing an estimate or quote to a customer before starting the job.

The workmen should be provided with PPEs to protect their health while carrying out the job. Workplace safety, cleanliness and hygiene should be maintained as agreed with the customer and meeting the rules and regulations stipulated by local/ state/ national bodies. Ensure compliance with child labour rules, payment of minimum wages and benefits as stipulated.

Notes



UNIT 4.7 Basic Business Terminology

Unit Objectives

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

1. List basic concepts and terminologies of business

If your aim is to start and run a business, it is crucial that you have a good understanding of basic business terms. Every entrepreneur should be well versed in the following terms:

- **Accounting:** A systematic method of recording and reporting financial transactions
- **Accounts payable:** Money owed by a company to its creditors
- **Accounts receivable:** The amount a company is owed by its clients
- **Assets:** The value of everything a company owns and uses to conduct its business
- **Balance sheet:** A snapshot of a company's assets, liabilities and owner's equity at a given moment
- **Bottom line:** The total amount a business has earned or lost at the end of a month
- **Business:** An organisation that operates with the aim of making a profit
- **Business to Business (B2B):** A business that sells goods or services to another business
- **Business to Consumer (B2C):** A business that sells goods or services directly to the end user
- **Capital:** The money a business has in its accounts, assets and investments. The two main types of capital are debt and equity.
- **Cash flow:** The overall movement of funds through a business each month, including income and expenses.
- **Cash flow statement:** A statement showing the money that entered and exited a business during a specific period of time.
- **Contract:** A formal agreement to do work for pay.

4.7.1 Business Entity Concepts

- **Contract:** A formal agreement to do work for pay.
- **Depreciation:** The degrading value of an asset over time.
- **Expense:** The costs that a business incurs through its operations.
- **Finance:** The management and allocation of money and other assets.
- **Financial report:** A comprehensive account of a business' transactions and expenses.
- **Fixed cost:** A one-time expense.
- **Income statement (profit and loss statement):** Shows the profitability of a business during a period of time.

- **Liabilities:** The value of what a business owes to someone else.
- **Marketing:** The process of promoting, selling and distributing a product or service.
- **Net income/profit:** Revenues minus expenses.
- **Net worth:** The total value of a business.
- **Payback period:** The amount of time it takes to recover the initial investment of a business.
- **Profit margin:** The ratio of profit, divided by revenue, displayed as a percentage.
- **Return on Investment (ROI):** The amount of money a business gets as return from an investment.
- **Revenue:** The total amount of income before expenses are subtracted.
- **Sales prospect:** A potential customer.
- **Supplier:** A provider of supplies to a business.
- **Target market:** A specific group of customers at which a company's products and services are aimed.
- **Valuation:** An estimate of the overall worth of the business.
- **Variable cost:** Expenses that change in proportion to the activity of a business.
- **Working capital:** Calculated as current assets minus current liabilities.
- **Business transactions:** There are three types of business transactions. These are:
 - **Simple transactions** – Usually a single transaction between a vendor and a customer. For example, buying a cup of coffee.
 - **Complex transactions** – These transactions go through a number of events before they can be completed. For example, buying a house.
 - **Ongoing transactions** – These transactions usually require a contract. For example: Contract with a vendor.

4.7.2 Basic Accounting Formulas

1. **The Accounting Equation:** This is value of everything a company owns and uses to conduct its business.
Formula: $\text{Assets} = \text{Liability} + \text{Owner's Equity}$
2. **Net Income:** This is the profit of the company.
Formula: $\text{Net Income} = \text{Revenues} - \text{Expenses}$
3. **Break-Even Point:** This is the point at which the company will not make a profit or a loss. The total cost and total revenues are equal.
Formula: $\text{Break-Even} = \text{Fixed Costs} / \text{Sales Price} - \text{Variable Cost per Unit}$
4. **Cash Ratio:** This tells us about the liquidity of a company.
Formula: $\text{Cash Ratio} = \text{Cash} / \text{Current Liabilities}$
5. **Profit Margin:** This is shown as a percentage. It shows what percentage of sales are left over after all the expenses are paid by the business.
Formula: $\text{Profit Margin} = \text{Net Income} / \text{Sales}$
6. **Debt-to-Equity Ratio:** This ratio shows how much equity and debt a company is using to finance its assets, and whether the shareholder equity can fulfill obligations to creditors if the business starts making a loss.
Formula: $\text{Debt-to-Equity Ratio} = \text{Total Liabilities} / \text{Total Equity}$

7. **Cost of Goods Sold:** This is the total of all costs used to create a product or service, which has been sold.

Formula: Cost of Goods Sold = Cost of Materials/Inventory – Cost of Outputs

8. **Return on Investment (ROI):** This is usually shown as a percentage. It calculates the profits of an

investment as a percentage of the original cost.

Formula: ROI = Net Profit/Total Investment * 100

9. **Simple Interest:** This is money you can earn by initially investing some money (the principal).

Formula:

$$A = P (1 + rt); R = r * 100$$

Where:

A = Total Accrued Amount (principal + interest)

P = Principal Amount

I = Interest Amount

r = Rate of Interest per year in decimal; $r = R/100$

t = Time Period involved in months or years

10. **Annual Compound Interest:** The calculates the addition of interest to the principal sum of a loan or deposit.

Formula: $A = P (1 + r/n)^{nt}$

Where:

A = the future value of the investment/loan, including interest

P = the principal investment amount (the initial deposit or loan amount)

r = the annual interest rate (decimal)

n = the number of times that interest is compounded per year

t = the number of years the money is invested or borrowed for

Tips



- It is very important to validate your business ideas before you invest significant time, money and resources into it.
- The more questions you ask yourself, the more prepared you will be to handle the high and lows of an enterprise.



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5. Coordinate with Colleagues and Customers

Unit 5.1 - Interacting with Superior

Unit 5.2 - Communicating with Colleagues

Unit 5.3 - Communicating Effectively with Customers

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Key Learning Outcomes



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

1. Learn behavioural skills to interact with your colleagues and co-workers effectively
2. Describe steps to achieve customer satisfaction
3. List quality and service orientation markers

UNIT 5.1 Interacting with Superior



Unit Objectives

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

1. Describe best ways of interaction with your superiors at work

1. Describe best ways of interaction with your superiors at work

An organisation is a group of people working collectively towards a common goal linked to an external audience/environment. Simply put, all the employees in an organisation act as tiny parts of a large machinery which help seamless and efficient functioning.

Every organisation must have a structure. The organisation structure enables clarity of purpose and role of every individual ensuring there are no overlap in functions. It also clearly defines a hierarchy which determine who takes what decision and thus how those decisions shape the organisation. These decisions provide the direction needed in the organisation.

Interpersonal relations / communication between employees across hierarchies are thus very important. A code of conduct / protocol ensures expectation management and reducing the gap between superior and subordinates by increasing the levels of trust and support ultimately achieving organisational and personal goals.

Openness and comfort in communication plays a very important role in achieving job satisfaction. Reporting problems and asking for possible solutions after your own unsuccessful attempts, taking feedback etc. all come under interactions with your superior.

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This image shows a blank sheet of white paper with horizontal ruling lines. At the top left, there is a header area with the word "Notes" in a bold, orange font. To the right of "Notes" is a small, empty rectangular box with an orange border. The rest of the page is filled with evenly spaced horizontal black lines for writing.

UNIT 5.2 Communicating with Colleagues

Unit Objectives

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

1. Describe best ways of communication with colleagues

Building trust with colleagues and co-workers is as important as doing your work efficiently and effectively. Here are a few actions you can take to build a relationship of trust and respect with your colleagues and co-workers:

- Greet everyone in the workplace with a smile and positive body language.
- Offer help to a new colleague to settle down in the job.
- Show courtesy and respect to colleagues.
- Do not disturb others when they are working.
- Keep your workstation clean.
- Leave washroom and other common facilities clean after use, for others.
- Do not waste your time and others' time by holding long conversations which are not related to work.
- Do not use cell phones at work.
- Do not mope. Keep a smiling face.

Following right communication rules is very important to keep a healthy relationship with colleagues and co-workers. In modern day workplace, people generally work in teams. It is important to build healthy relationship with the team members. Following are some important communication rules to follow:

- Speak in a polite and respectful tone. A voice tone suggesting impatience, sarcasm or taunt is not acceptable in the workplace.
- Use positive words and body language. Avoid words and topics which may offend anyone at workplace.
- If there is any conflict with a co-worker, resolve the issue amicably without raising your voice or getting angry.
- Greet your colleagues and co-workers in the morning or at the beginning of the shift.
- Use positive words and body language.

The quality of relationship you build with your colleagues and co-workers will depend on the behaviour you demonstrate while interacting with them. A relationship built on trust, good and clear communication, polite language and appropriate behaviour at all times helps you to be successful at work.

UNIT 5.3 Communicating Effectively with Customers

Unit Objectives



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

1. Describe best way of communicating with customers
2. List quality and service satisfaction markers

A customer in your context is anyone – internal or external who might legitimately have a work-related expectation from you. Both their opinions are critical to the success of your company and sale of your products.

Internal customers are persons within the organisation who use products or services delivered by you as inputs in their work. For example, production staff in a factory are internal customers of maintenance technicians. The feedback provided internal customers is valuable. It must be implemented and taken seriously.

External customers are the end consumers and/or companies who buy your products. They do not belong to your organisation. These individuals are essential to the success of your company, as they purchase your product. Satisfied external customers make repeat purchases. They also refer the experience to others.



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- Understanding customer expectations and implementing the same helps achieve customer satisfaction. Delivering more than expected adds to the overall experience of a good sale. It brings repeat customers.
- Managing customer relations requires dedicated and committed effort. It involves understanding the customer's need correctly and fulfilling it every time. With a business customer, it involves understanding their business and in what ways our product / service can help grow and improve their business.

General tips for interactions with customer are as follows:

- Greet and welcome the customer in a friendly manner
- Make an earnest effort to understand customer needs. Ask specific pertinent questions.
- Be attentive, listen carefully and make notes. Suggest upgradation and add-ons if they give value to the customer.
- Find out customer's likes and dislikes by soliciting their opinion and comments on the demonstrated samples
- Never promise more than you can deliver. Always deliver more than you promise, never fall short
- Agree on all terms and conditions

When the customer is another organisation (such as an OE company, a cooperative society or a club), many persons from the customer organisation get involved. Each may have different needs and expectations. In such situations,

- Identify all the stakeholders (internal and external) and opinion makers right at the outset and understand their needs
- Understand the organisation's strategy and its priorities. This is critical to understanding which needs rank high.
- Be aware that there will be internal dynamics at work in any organisation, and one needs to steer clear of getting caught up in any interpersonal conflicts.
- Document what will be delivered (quantities, specifications and timelines) with a formal sign-off from the customer's side. This can avoid misunderstanding and disappointment later. Such document should also list key expectations from the customer that are critical for timely and quality delivery.
- With a long-term customer, explore ways of bringing about continuous improvements that can help the customer's business. This is critical to keep getting continuing business.
- Be available to deal with the customer's queries and concerns promptly and at all times.

Notes





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Quality is the sum total of all the elements connected with the product and service that impact the customer's perception positively. Examples are the product's functional performance, aesthetic appeal, reliability, durability, quality of the material used, meeting the design specifications of the end user, customer service during and after the delivery etc. The test of quality is when the customer is totally satisfied with the product in every respect.

Service orientation is the ability and desire to anticipate, recognise and meet customers' needs. It is a personality characteristic which makes people focus on providing satisfaction and making themselves available to others. Excellent customer service is unthinkable without customer service orientation.



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Customer satisfaction means the customer is satisfied and happy with the work we have done. A satisfied customer is ready to give us repeat business or recommend us to friends and acquaintances.

Customer satisfaction is important because in today's competitive market place every business competes for customers. Your business is constantly under threat from competition trying to take it away; consistently maintaining high customer satisfaction is crucial to retain customers for the long term. Customer satisfaction is the best indicator that the customer is likely to be a repeat customer. It is always cheaper to retain an existing customer than to acquire a new one.

Tips



Always remember customer is King! Think of the many ways in which you can contribute to increased customer satisfaction.

Notes



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6. Maintain Standards of Product / Service Quality

- Unit 6.1 - Meeting and Exceeding Customer Expectations
- Unit 6.2 - Coating Defects, Tests and Standards
- Unit 6.3 - Your Responsibility as a Wood Polisher
- Unit 6.4 - Prevention of Injuries

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Key Learning Outcomes

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

1. Explain product / service quality requirements for wood polishing
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 wood polishing

UNIT 6.1 Meeting and Exceeding Customer Expectations

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.

A thorough understanding of the total polishing system is necessary to begin the discussion with the customer.

1. Understand customer requirements:

You should be able to obtain clear instructions and specifications from the customer about the desired finish, look, durability expectation and corrosion protection specifications. Some customers may not have a clear idea about their requirements. In such cases they will need to be guided. Prepare a few samples and get the customer to choose finish, gloss, and shade, which are some basic visual requirements for a coated film.

Established industries generally have well defined specifications stating their requirement. However, even here it is necessary to engage with the customer to ensure common understanding on tolerances, subjective parameters, working limitations and skill levels at customer factory as well as other unstated terms. For example

- When the customer asks for exact match to a standard colour panel, what is the level of tolerance permitted? Will the customer go by visual judgement or by an instrument match?
- What are the testing methods and standards that the customer would use?
- What is the process for maintaining and updating standard panels?
- What are the application equipment, parameters and conditions at the customer end?
- Are there any work restrictions at the customer's premises, for example on working hours, holidays, use of elevators, etc.? It is important to be clear on these while committing to aggressive completion targets.
- Can we describe what performance would be seen as exceeding the customer's expectations?
- Does the customer have internal targets for continuous improvements over time? What are the expectations from the coating supplier/ contractor in this regard?

2. Understand the total coating application system/process, nature of the facility and limitations:

Delivering good and consistent quality in the design, production or application of paints and coatings requires understanding application conditions in detail. This includes obtaining insights and information on all relevant factors such as:

- Type and quality of the substrate and variations that may be encountered
- Surface preparation needed

- The type of coatings to be applied
- The application equipment available/ needed
- Applicable/expected quality standards
- Ambient conditions and site conditions
- Maximum size of components which can be fitted
- Overall magnitude of the job
- Maximum weight the conveyor can take (known as point load)
- Bake conditions, oven design, baking window
- Support facility limitations (e.g. conveyor speed, maximum loading etc.)

3. Fool-proof the process and have the right equipment

Analyse and find areas which need to be corrected to gain control of the overall process. This will reduce variations/ surprises and facilitate meeting quality expectations in a consistent and timely manner.

- Inspect the material(s) to be coated before starting the process to ensure good quality and good finish
- Check materials and consumables to be used. Make sure that they conform to specifications
- If the input jobs do not meet the requirements, discuss with the customer and quality in-charge and take appropriate actions
- Follow the right processes and use correct equipment for the job
- Ensure that applicable SOPs are adhered to

4. Get feedback from the customer and incorporate suggestions for improvement:

- After delivering the product/ output, proactively find out specific customer feedback
- Make a note of the feedback and improvements the customer is looking for
- Tell the customer what improvements you will incorporate in the next job

6.1.1 Quality Standards of the Company

When coating is carried out under proprietary or customer specifications usually the following criteria are considered to check the quality of the finished job.

- On visual inspection, the coating should show the desired finish and correct curing without defects or blemishes.
- Mechanical strength checks are performed to ascertain that the DFT (Dry Film Thickness), hardness and flexibility criteria are met
- The film is tested for corrosion resistance. This may include salt spray resistance test, humidity resistance test etc.
- Outdoor durability tests include ultraviolet resistance test and actual outdoor resistance test



UNIT 6.2 Coating Defects, Tests and 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. Describe the ways to improve company's customer satisfaction rating.

A company's policy defines and helps ensure adherence to quality standards.

- What kind of durability must the finished product meet?
- What are the criteria laid out for the quality assurance program?
- What are the customer specifications?

Based on these a 'Standard Operating Procedure' or 'SOP' is generated with specific work instructions. An **SOP** is a procedure specific to the operation that describes the activities necessary to complete tasks in accordance with industry regulations, legal requirements and quality standards

Why is it important to follow an SOP?

- Saves time and eliminates mistakes
- Ensures that consistent standards are followed throughout the process
- Reduces training costs
- Supports quality goals

6.2.1 Tests and Standards to Check Quality

- Dry Film Thickness (DFT) measurement
- Gloss
- Colour
- Flexibility / bend test
- Pencil hardness test
- Adhesion test

6.2.1.1 Dry Film Thickness (DFT) Measurement

This test is devised to check the correct coating thickness on the components as per the specifications.

- Dry film thickness (DFT) is the thickness of the coating
- DFT is measured for cured coatings. Proper thickness range is recommended in specifications

- There are various types of DFT gauges available in the market, from simple magnetic gauges to digital gauges
- The gauge should be calibrated periodically by using a bare metal plate (zero setting) and standard thickness plastic foils (shims) which are supplied with the gauge
- Different gauges are available for ferrous and non-ferrous substrates (F and NF)
- Destructive method or ultrasonic method of DFT measurement is used for non-metallic substrates like wood, plastic, etc.



Fig 6.2.1.1 (i): Magnetic Gauge



Fig 6.2.1.1 (ii): Digital Gauge

6.2.1.2 Gloss Check



Fig 6.2.1.2: Gloss meter

- Gloss is measured with Gloss Meter of different designs. The reflection is measured, and the angle of reflection is specified at 20°, 45°, 60° and 85°
- An angle of 60° is most common in the coating industry
- An angle of 20° is used for a more differentiated result of high gloss surfaces; usually recommended for Automotive class "A" finish
- An angle of 85° is used for a more differentiated result of matt surfaces, not so popular in coating industry

6.2.1.3 Colour Check

Colour may be checked visually or using a computer aided spectrophotometer. If measured by a spectrophotometer, the colour difference is reported as ΔE (Delta E). The ΔE should fall within the demarked tolerance zone.

- Visual inspection, compared to a master. It is very important to use a relevant light source when judging colour
- Computer aided spectrophotometer
- Stationary equipment or portable equipment



Fig 6.2.1.3: Spectrophotometer

6.2.1.4 Flexibility - Bend Test

This test is to determine the elasticity, adhesion and elongation ability of a dry coated film applied on a flat metal support. **This test cannot be performed on rigid substrates like wood, plastic, etc.**

- It is checked using either a conical or cylindrical mandrel with a graduated scale
- The apparatus contains a holder for a mandrel, a bending lever fitted with height adjustable rollers, and sliding tongs for fastening the sample
- It is a laboratory apparatus to bend coated test panels over a conical/cylindrical shaped mandrel in order to assess the elasticity of the coating, in accordance with ISO 6860 and ASTM D522
- The conical shape of the bending area allows the deformation of the test panel and examination of the elasticity range of a coating over any diameter between 3.1 and 38 mm in one single test

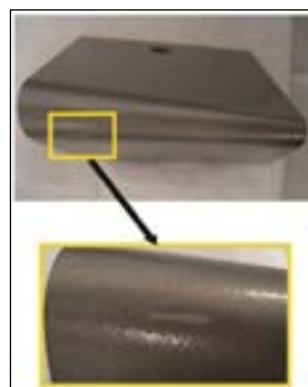
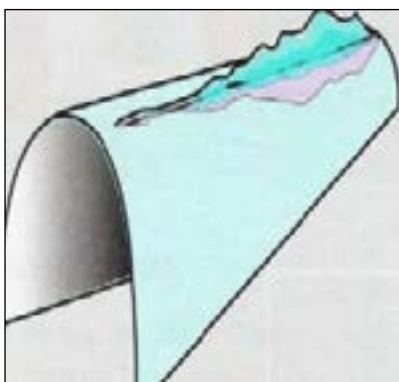


Fig 6.2.1.4: Bend test on a conical mandrel

6.2.1.5 Pencil Hardness Test



Fig 6.2.1.5: Pencil Hardness Test

Pencil hardness test is one of the many tests used to evaluate coatings. It is a simple and dependable test that uses pencils that are graded. The grade of the pencil is determined by the amount of baked graphite and clay in its composition. The test is performed by scratching the coated surface with pencils of known hardness.

Softer Pencils							Harder Pencils						
6B	5B	4B	3B	2B	B	HB	F	H	2H	3H	4H	5H	6H

6.2.1.6 Adhesion Test

Adhesion test is used to determine if the paint or coating will adhere properly to the substrate to which it is applied. There are three different tests to measure the adhesion of the coating to the substrate.

- Cross-cut test
- Scrape adhesion
- Pull-off test

Cross-cut test: This test determines the resistance of the coating to separation from the substrate by utilising a tool to cut a right-angle lattice pattern into the coating, penetrating all the way to the

substrate. It is a quick test to establish pass/fail test. When testing a multi-coat system, the resistance to separation of different layers from one another can be determined by this test.



Fig 6.2.1.6 (i): Adhesion test fail



Fig 6.2.1.6 (ii): Adhesion test pass

Pull off dolly test: Unlike the other methods, this method maximises the tensile stress, therefore results may not be comparable to the others.

- The test is done by securing loading fixtures (dollies) perpendicular to the surface of a coating with an adhesive. Then the testing apparatus is attached to the loading fixture and is then aligned to apply tension perpendicular to the test surface.
- The force that is applied gradually increases and is monitored until a plug of coating is detached

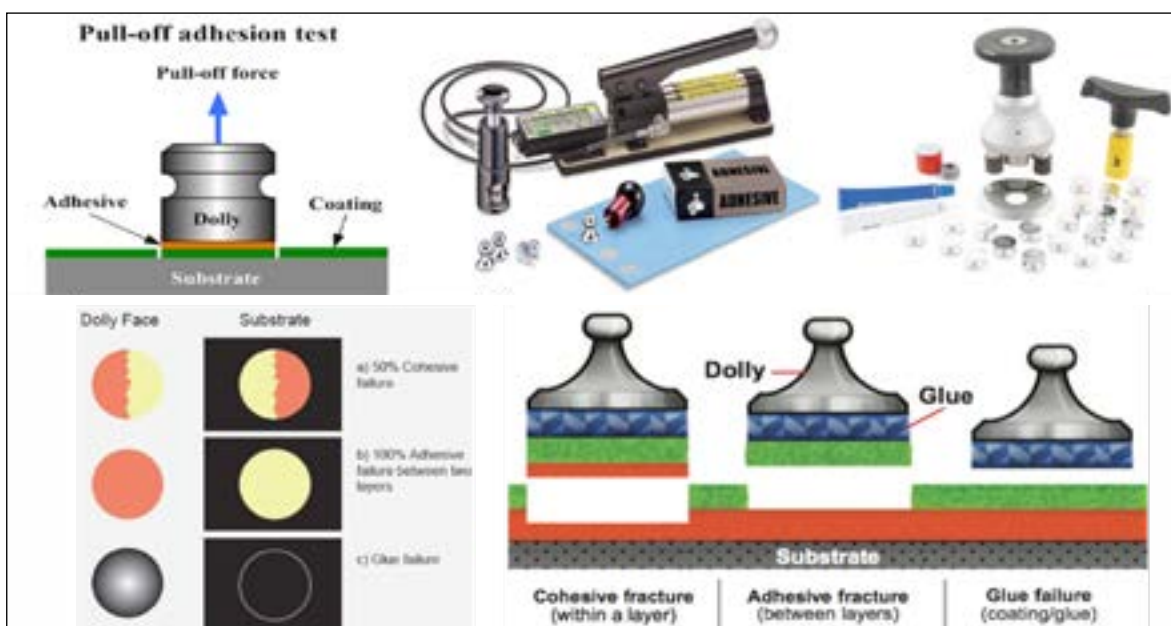


Fig 6.2.1.6 (iii): Pull-off Adhesion Test

6.2.1.7 Impact Test

Impact test is also known as drop weight test. The coated panel is subjected to mechanical impact by dropping a standard weight which can deform the coating and /or the substrate. With this test coating is tested for elasticity, brittleness, and adhesion to the substrate. As per ISO 6272-1:2011 - it is a method for evaluating the resistance of a dry coating film to cracking or peeling from a substrate

when it is subjected to a deformation caused by a falling weight, with a 20-mm-diameter spherical indenter, dropped under standard conditions.

- Measures the deformation of a coating film
- Test performed on the front and reverse sides of a panel
- Result expressed as Pass or Fail
- Test is mainly performed on metal substrate.

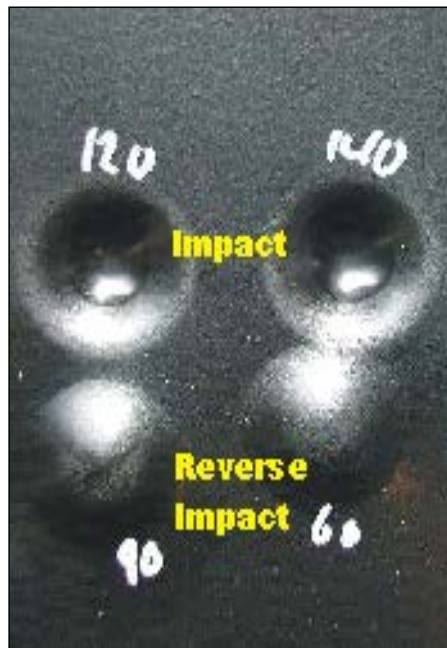


Fig 6.2.1.7 (i): Impact Tester Fig 6.2.1.7 (ii): Impact Test

6.2.2 Defects in Wood Coating

The following are the frequently encountered defects in wood coating and its probable causes.

No.	DEFECT	CAUSES
1	RUNDOWN (SAGGING)	<p>This problem is normally seen in finishing lacquer on vertical surfaces if a very thick coat is applied. This defect arises from:</p> <ul style="list-style-type: none"> • Application of too much paint thickness in one go. • The use of lacquer with low viscosity (excess thinner in lacquer). • Improper application if the spray gun is held at a very short distance or is not parallel to the job surface. • Air pressure of gun is too low. • Solvent / thinner evaporation is very slow.

2	ORANGE PEEL OR SPRAY RIPPLE	<p>The painted surface looks like the skin of an orange. It may be caused by:</p> <ul style="list-style-type: none"> • Excessive film thickness. • Improper adjustment of spray gun pressure and pattern. • Air pressure too low or high. • Thinner evaporation too fast. • Too hot or too cold temperature of the job surface. • Improper flow of paint. • Paint pot life expired. • Gun distance not correct.
3	POOR HIDING	<p>This defect is related to pigmented solid colour finishes. Uneven colour appearance in the paint film is observed. Possible causes:</p> <ul style="list-style-type: none"> • Pigment separation due to poor mixing in the tin. • Too much thinner used. • Improper spraying strokes.
4	WATER SPOTTING	<p>During spraying water droplets are observed in the film creating spots. Possible causes:</p> <ul style="list-style-type: none"> • Water drops coming through compressed air. • Rain or dew setting on the sprayed film. • Water splashing from water curtain spray booth on job while spraying.
5	UNEVEN FILM THICKNESS	<p>Many times, paint thickness varies in the film. Could be caused by:</p> <ul style="list-style-type: none"> • Thinner evaporating too slow or too fast. • Improper spraying technique. • Spray over lapping not proper. • Lack of illumination level, which should be 400-600 lux (Diffused) on job.
6	WRINKLING / LIFTING	<p>Wrinkle type structure / lifting is observed in lacquered film. Possible causes:</p> <ul style="list-style-type: none"> • Excessive film thickness. • Abnormally hot or humid drying environment. • Undercoat and topcoats not compatible and may get damaged by / react with the thinner of the next coat. • Undercoat not cured properly and when the topcoat is applied, the thinner from topcoat attacks the earlier coat and lifts the coat.

7	GLOSS VARIATION	<p>Variation in gloss observed due to,</p> <ul style="list-style-type: none"> • Paint film too thin or thick, improper overlapping of paint during application. • Application on incomplete dried undercoat. • Drying conditions are too cold or too humid. • Improper thinner used in paint. • Hardener too low or high. • Thinner drying too fast for the ambient temperature.
8	DRY SPRAY	<p>Dusty or gritty appearance is observed in painted film. Causes could be:</p> <ul style="list-style-type: none"> • Insufficient thinner during spraying. • Thinner drying too fast. • Excessive air pressure during spraying. • Excessive air movement in spray booth or in open. • Overlapping strokes are not proper during spraying with spray pattern too wide.
9	SLOWER DRYING	<p>Many a times slower drying of paint is observed. This could be due to:</p> <ul style="list-style-type: none"> • Application on greasy or oily surface. • High thickness of applied paint. • Poor ventilation during drying. • Drying atmosphere too cold or humid. • Oil / water in compressed air. • Hardener mix ratio not as per supplier's recommendations
10	CRACKING	<p>Fine cracking is observed after drying. Possible causes:</p> <ul style="list-style-type: none"> • Paint is not properly mixed before application. • Use of French polish as undercoat. • Powerful thinner in top coat which reacts with undercoat. • Undercoat too thick and not cured properly. • Hardener mix ratio not as per supplier's recommendations. More hardener added. • At joints due to expansion and contraction of wood substrate. Using more flexible coating after drying to be used, i.e. PU will be more flexible than melamine.

11	PINHOLING	<p>Fine pinholes or fine air bubbles are observed in film, could be due to:</p> <ul style="list-style-type: none"> • Moisture entrapped in the wet coating film • Thinner evaporating too fast. • Insufficient drying time between 2 coats, and if thinner is entrapped in undercoat. • Paint film is applied thick and the thinner is fast evaporating type. • Thinner entrapped in the paint film when paint film gets partially dried.
12	BLUSHING – LOSS OF GLOSS / MILKYNESS IN SOME AREAS	<p>Possible causes:</p> <ul style="list-style-type: none"> • When the thinner in the paint evaporates, there is localised cooling, and water from atmosphere condenses due to high humidity. Suggested solution: use slower drying solvents. • Mostly found in topcoats / lacquers in cold and humid conditions, which form milky or whitish appearance.
13	PAINT PEEL OFF – COAT PEELING	<p>Caused by:</p> <ul style="list-style-type: none"> • Previous coat not being compatible with upper coat. Do not mix different types of coating systems like PU on Melamine or NC. • Very thick previous coat that is not fully dried. In such a case the upper film may peel off. • Surface is oily, next coat will not adhere. Care should be taken by operators and helpers to avoid oily hands. Generally, they might apply hair oil and oil may get transferred to hands, while handling the surface and result in adhesion failure. Ideally using head caps is safer.
14	SAND SCRATCH MARKS	<p>Caused due to:</p> <ul style="list-style-type: none"> • Use of improper coarse sand paper • High sanding pressure.
15	DARK AND LIGHT STAIN PATCHES	<p>The reason could be:</p> <ul style="list-style-type: none"> • Uneven sanding of the wooden surface. • Only coarse sand paper used for sanding resulting in deep and wide scratch lines on the wooden surface and hence uneven wood stain absorption. Therefore, colour variation observed on the wood stain. • To avoid this problem, use finer sand paper grit after coarse sand paper grit.

16	STAIN PATCHES	<ul style="list-style-type: none"> • Wrong application strokes by applicator. • Very slow or speed variation during wood stain application • Cotton rag or brush does not soak sufficiently while applying the wood stain. • Overlapping of brush or cotton rag while wood staining.
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Fig 6.2.2 (i): Rundown (Sagging)

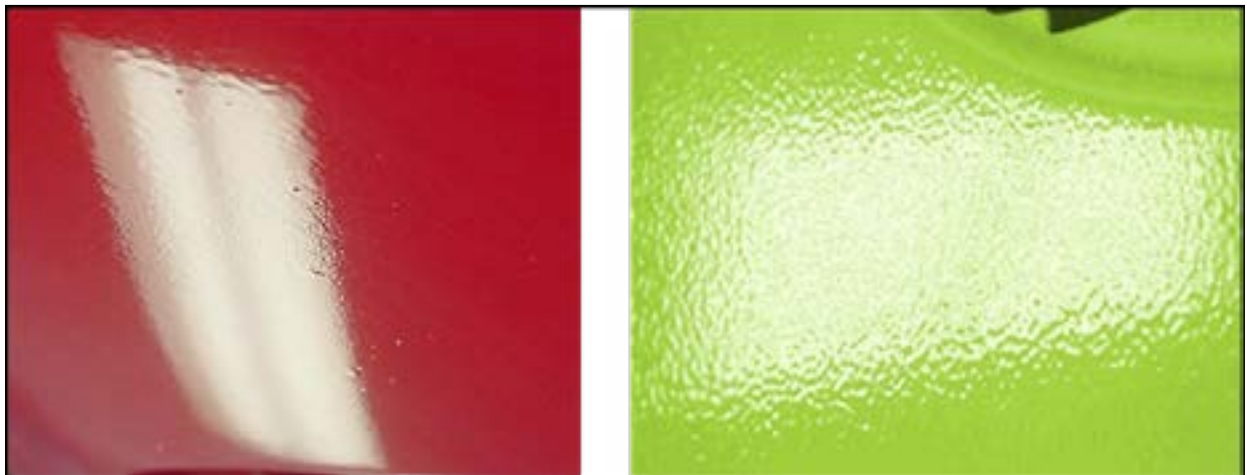


Fig 6.2.2 (ii): Orange peel or spray ripple

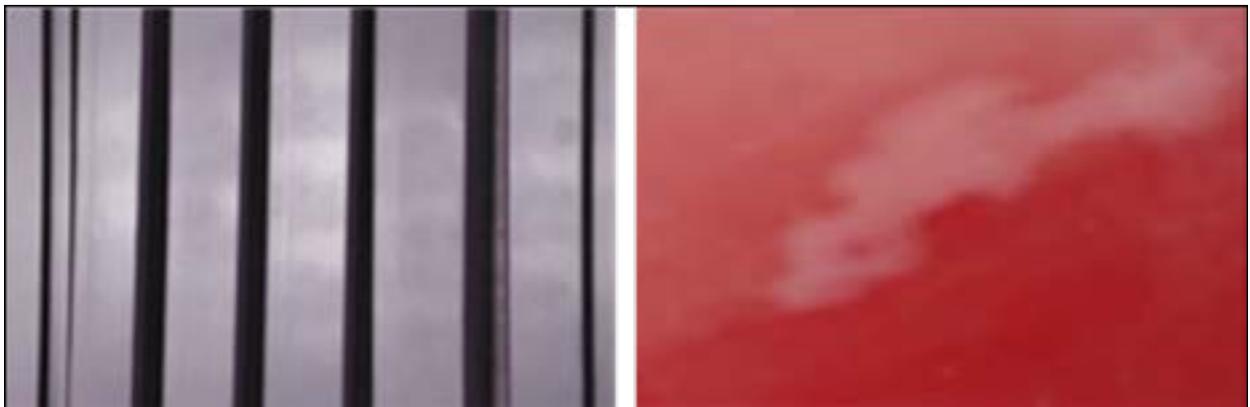


Fig 6.2.2 (iii): Poor hiding



Fig 6.2.2 (iv): Water spotting



Fig 6.2.2 (v): Uneven film thickness



Fig 6.2.2 (vi): Wrinkling / lifting

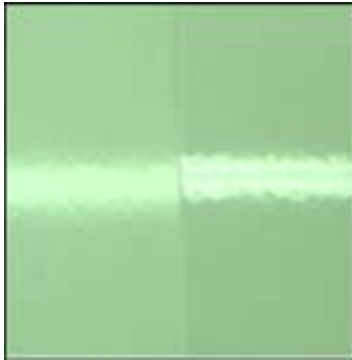


Fig 6.2.2 (vii): Gloss variation



Fig 6.2.2 (viii): Dry spray



Fig 6.2.2 (ix): Slower drying



Fig 6.2.2 (x): Cracking



Fig 6.2.2 (xi): Pinholing



Fig 6.2.2 (xii): Blushing



Fig 6.2.2 (xiii): Peel off



Fig 6.2.2 (xiv): Sandpaper scratch marks



Fig 6.2.2 (xv): Dark and light stain patches

NOTE: Excessive coarse sanding results in additional absorption of stain making darker patches

[illegible]

UNIT 6.3 Your Responsibility as a Wood Polisher

Unit Objectives



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

1. Organise paint material and tools for painting as per customer's requirement
2. List down the quantity of paint consumed and consumables used to work out the cost incurred

Your job responsibilities may vary from job to job, but general duties always include:

- Obtain, read, and fully understand the coating specification. Bring up any questions with the appropriate person, and get them resolved
- Fully comply with specification requirements and that work performed matches the required standard of quality
- Determine that all essential raw materials, especially coatings, are stored correctly and used in batches within the manufacturer's recommended shelf life
- Maintain records of all work done, the conditions under which it was done, and any other appropriate report items required by the supervisor
- Ensure that the necessary test instruments and standards required are available at all times and that each instrument is fully functional and properly calibrated

Note



UNIT 6.4 Prevention of Injuries

Unit Objectives



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

1. Apply safe working practices to avoid injuries due to use of high-pressure equipment, moving parts and electric shocks
2. Identify toxic ingredients by reading a MSDS and use recommended PPE

Avoiding skin injections:

- Stay clear of high-pressure fluid streams and sprays
- Never remove protective devices, such as spray gun tip guards, during application
- Use proper pressure-relief procedures
- Use proper flushing practices described in instruction manual
- Never try to stop leaks with your hands or body
- Always use the spray gun trigger safety lock when not spraying
- Don't feel for leaks with your hands or a rag

Avoiding pressure-related injuries:

- Do not exceed the working pressure ratings (WPR) of components, paying special attention to high-pressure equipment
- Operate the motor within the recommended air or hydraulic pressure
- Do not repair permanently coupled hoses
- Use only genuine service parts as specified by the manufacturer
- Properly align spray tips to prevent back-spray
- Do not use low-pressure fittings on high-pressure equipment
- Do not use damaged or worn out equipment
- Check for proper connections and make sure they are tight before pressurising the system
- Follow procedures for relieving fluid pressure whenever you stop equipment for service or repair

Avoiding injury from moving parts:

- Never operate equipment with guards or other protective devices removed
- Check regularly to ensure that safety devices are operating properly
- Properly use bleed type shut-off valves

Avoiding toxicity:

- Use recommended personal protection equipment (PPE) to avoid contact with hazardous materials
- Read and follow directions on all coating material labels and material safety data sheets (MSDS)
- Never operate gas engines indoors

Avoiding electric shocks:

- Properly ground all objects in the system, including operators
- Follow the procedures in instruction manuals to avoid shocks from electrostatically charged components
- Never operate electric equipment when it is wet or when the surrounding area is wet
- Use only grounded outlets, extension cords and fluid hoses designed for high-pressure spraying that are in good condition
- Do not modify or remove electrical cords

Tips



Defects on the painted / coated surface reflects poor skills and workmanship. This may lead to early failure of the coating. Hence a greater emphasis on excelling at your job is important.

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7. Maintain OH&S Standards and Follow Environmental Norms

**PAINTS AND
COATINGS
SKILL COUNCIL**



- Unit 7.1 - Responsibility Regarding Safety
- Unit 7.2 - Waste Disposal
- Unit 7.3 - Use Safety Tools and Personal Protective Equipment (PPE)
- Unit 7.4 - Handling of Coating Materials and Equipment as per Safety and Environmental Standards
- Unit 7.5 - Precautionary Measures

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Key Learning Outcomes



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

1. List the personal protective equipment and its uses to be used at the workplace
2. Explain the precautionary measures for emergencies

UNIT 7.1 Responsibility Regarding Safety

Unit Objectives



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

1. Explain safety
2. Identify various types of hazards in your workplace
3. Describe what an MSDS is and why it is important

Safety is the responsibility of all employees whether at the job site or in a factory. The employer has the prime liability for safety, but every employee should be knowledgeable on safety. They should be able to work in a safe manner without any safety violation.

As a member of the plant team or the site team you are responsible for:

- Your own safety
- Reporting any unsafe conditions or practices to the safety engineer or supervisor
- Following all specific safety requirements as set forth in the specification and by the safety engineer or supervisor
- Adopting safe practices while working with solvents, coatings, spray equipment, scaffolding, abrasive blasting, etc.
- Knowing the location of first aid stations
- Knowing the location of the nearest telephone and emergency telephone numbers like ambulance, fire department, safety engineer etc.

7.1.1 Primary Hazards

Fire	Explosion	Reactivity	Health Hazards
<ul style="list-style-type: none"> • All solvent based coatings, whether in a container or as a wet film on a surface, are flammable. In most cases, the coating's binder resin is also flammable. Precaution should be taken to prevent a spark or a flame from coming in contact with wet film or liquid paint. 	<ul style="list-style-type: none"> • When sufficient solvent vapour is present in the air, a spark or a flame, can cause the entire air volume to react at one time, creating an explosion. Explosion can occur without fire, although they are often combined. Every effort should be made to prevent the solvent-air mixture from reaching 50% of the lower explosive limit. 	<ul style="list-style-type: none"> • Reactivity is not ordinarily a major problem from safety standpoint. However, in two pack systems, the mixing of the base and the hardener makes the system reactive and can generate substantial amount of heat. Epoxies, polyurethanes, and similar reactive materials such as polyesters catalysed with acid, develop a substantial amount of heat, whenever they are mixed. Hence the base and the hardener or catalyst should be stored separately. 	<ul style="list-style-type: none"> • Most coatings are not so toxic and protective clothing and proper equipment can provide full protection. Any worker sensitive to heights should not work on ladders, scaffolds, or rigs.

7.1.2 Hazards Associated with Coating Materials and Equipment

Most paint materials are hazardous to some degree. All paints, except water-based paints are flammable; many are toxic, and others can irritate the skin. However, most paints are quite safe to use if simple precautions are followed every time.

Among paint raw materials, solvents, resins and solvent based drier solutions are flammable. Some solid materials such as metallic powders carry explosion risk. Products such as fungicides used in certain water-based paints are toxic. Powder raw materials such as pigments and extenders pose risk of inhalation. All these materials need to be handled with appropriate personal protective equipment and, following all safety instructions correctly.

Surface preparation materials like solvents, acid or alkali cleaners can cause skin irritation if not used with care.

Due precautions need to be observed during the use of high pressure abrasive or water blasting methods for surface preparation. Safety gear should be used when using ladders, scaffolds and rigs for working at heights.

Slippery floors and obstacles located on the floor may cause falls.

Electrical /mechanical equipment may produce shocks or other serious injuries if not handled with care. An obvious hazardous location is the interior of a tank at a paint factory or at a customer site. Deviations or taking short cuts and not following proper procedures may produce unsafe working conditions which may result in accidents, loss of life, time and materials.

7.1.3 Chemical Hazards

Chemical manufacturers are required to evaluate chemicals produced to determine if they are hazardous. The manufacturer reviews the chemical substance to determine if it is carcinogenic, toxic, irritant or dangerous to human organs, flammable, explosive, or reactive. This information is available in the material safety data sheets (MSDS) that are supplied with materials.

What is a Material Safety Data Sheet (MSDS)?

A Material Safety Data Sheet (MSDS) is an information sheet that lists the hazards, safety and emergency measures related to specific products. An MSDS is required for industrial products used in the workplace like chemicals, paint, thinners, pretreatment chemicals and cleaners.

Why do I need to use an MSDS?

You may want to know if there are chemicals in the products that can cause adverse health effects such as allergies or asthma during its handling and use. This information may be helpful to prevent exposure to chemicals from new products or in finding out if existing products may be causing symptoms.

Where can I get an MSDS?

Suppliers provide a MSDS for each product supplied to the customer. This may be available with the safety department of your company. You may also obtain an MSDS from data bank available on internet.

Why is an MSDS sheet required for a medical emergency?

In an emergency, the doctor can request an MSDS, to understand the nature of the hazard and the anti-dote recommended for treatment.

Where can I get more Information?

Some product labels include a full list of ingredients. Some suppliers will provide a full list if you request it. You can also ask the supplier's chemist for more information, including a list of additional ingredients.

Are all ingredients Included in MSDS?

No. Only specific hazardous chemicals are mentioned on a MSDS. Thus, perfume or a chemical odorant that may not be considered hazardous may not show up in the MSDS. Manufacturers do not disclose information they consider proprietary. Such information may relate to the chemical composition.

The MSDS lists each required substance that makes up more than 1 per cent of the product. However, if the chemical causes cancer, respiratory sensitisation, or reproductive effects, then it must be listed even if it makes up more than 0.1 per cent.

How much of a chemical is a problem?

It is important to consider several factors to determine if you should be concerned. For example, the quantity, toxicity and other effects, and the potential exposures of each chemical are important to think about. It is also important to know that most of the information on an MSDS relates to exposure to one chemical at a time.

Technical Terms: Listed below are some definitions of terms you may find on an MSDS.

- **Carcinogen:** causes cancer
- **Hormonal:** some chemicals act like hormones
- **Reproductive toxin:** damages the male or female sex organs, sperm, or eggs
- **Sensitisation:** a body response which makes you react to a smaller amount than before
- **Teratogen:** causes developmental abnormalities to the foetus (unborn child)
- **Toxin/toxic:** poison/poisonous

MATERIAL SAFETY DATA SHEET			
2020 E. Orangethorpe Ave., Fullerton, CA 92631			
Chemical Name	Vinyl Acrylic	HAZARD RATING	
Formula No	100	4 - Extreme	<div style="display: flex; align-items: center; justify-content: center;"> <div style="text-align: center;"> Fire 1 0 </div> <div style="text-align: center;"> Reactivity 0 0 </div> </div>
Chemical Family	Vinyl Acrylic	3 - High	
Trade Name	Cerama-Tech	2 - Moderate	
		1 - Slight	
		0 - Insignificant	Special
I - PHYSICAL DATA			
Appearance, Odor	liquid, mild odor	Solubility in water	yes
Boiling Point	250° F	Specific Gravity (H ₂ O = 1)	1.428
Vapor Pressure (mm Hg)	.02	Percent Volatile by Volume	42.22%
Vapor Density (air=1)	N/A	Evaporation Rate (Butyl acetate=1)	N/A
II - HAZARDOUS INGREDIENTS			
Material	Cas Number	OSHA PEL	TLV
Ethylene Glycol	107-21-1	N/A	100 PPM
Texanol	25265-77-4	N/A	N/A
III - FIRE AND EXPLOSION HAZARD DATA			
Flash Point	248° F	AUTO IGNITION TEMPERATURE that of water	
LEL %	.62	UEL (%)	4.24
		DOT Category	NON FLAMMABLE
Extinguishing Media	Foam, CO₂, Dry Chemical		
Special Firefighting Procedures	Avoid confined spaces unless properly protected against potential irritating and toxic fumes.		
Unusual Fire and Explosion Hazards	KEEP AWAY FROM HEAT. Containers may explode when exposed to extreme heat.		
<small>Although the manufacturer has attempted to provide current and accurate information concerning the chemical properties listed herein, the manufacturer makes no representations regarding the accuracy or completeness of the information listed herein and assumes no liability for any loss, damage or injury of any kind which may result from or arise out of or reliance on the information listed herein by any person.</small>			

Fig 7.1.3: Material Safety Data Sheet (freeenergystore.com)

Notes



UNIT 7.2 Waste Disposal

Unit Objectives

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

1. Describe how and why improper waste disposal is hazardous

Impact of dumping waste in the open:

- Water pollution – toxic liquid seeps into surface and groundwater
- Soil pollution – toxins seeps into the soil and surrounding vegetation
- Dump fires – waste decomposition releases inflammable methane which can result into explosion
- Disease – flies, rodents and pets can spread diseases from open dumpsites
- Other impacts – visual ugliness, foul smell, bird menace which can be a hazard to airplane

Waste is treated in an effluent treatment plant, as recommended by the supplier and then disposed of safely, in a specially designed landfill with protective measures to save the environment. Landfills also serve as a backup in case of malfunction in the plant treatment facility.

A good deal of waste is generated even in a simple household painting or polishing job. Such waste includes used sand paper, waste papers, used masking tapes, dust resulting from sanding, waste solvent, waste water after cleaning brushes and containers, empty containers, cotton rags, waste paint etc. It is important to plan, in advance how to minimise such waste and how to safely collect and dispose them off.

Never assume that it is the job of the customer to deal with the waste. Do not throw these sneakily into household waste bins. The waste collection systems in a house or a cooperative housing society may not be designed for such waste.

Discuss the options with the customer before starting the work. At the least most housing waste collectors (such as municipal trucks) would expect the waste to be segregated and handed over. Items that can be recycled (such as used tins and bottles should be sold to scrap dealers who deal in such scrap. Flammables such as solvent soaked cleaning rags should be disposed in a safe manner.

Notes

UNIT 7.3 Use Safety Tools and Personal Protective Equipment (PPE)

Unit Objectives



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

1. List the different types of personal protective equipment mandatory while working

Personal Protective Equipment (PPE) and their usage is not an option; it must be practiced always without any deviations. In case of emergency, ensure you safeguard yourself first before helping others.

Personal Safety	Ladders	Scaffolding	Power Tools
<ul style="list-style-type: none"> • Use Personal Protective Equipment (PPE) to limit exposure to the eyes while handling powders or while spraying paint • Use regulated air respirator while spraying • Position yourself upwind of object being sprayed 	<ul style="list-style-type: none"> • Use ladders that are stable • Wear shoes with heels • Inspect for loose, worn, or damaged rungs • Do not carry any tools in hand while climbing • While climbing face ladder, never jump from a ladder • Guard against metal ladder coming in contact with electric power lines 	<ul style="list-style-type: none"> • Inspect for damage or deterioration • Ensure scaffolding is plumb and level • Ensure handrailing is provided on all scaffolding 	<ul style="list-style-type: none"> • Verify safety guards are fitted and operational • Dust collection systems are operational when working with hazardous materials

Recommended PPEs

1. Gloves

- (a) Nitrile gloves - used against solvent handling / painting
- (b) Leather gloves - used against handling hot objects / blasting
- (c) Surgical gloves - made up of latex, general purpose
- (d) Polyethylene and cotton gloves - in powder coatings / painting

A painter should not use gloves as his hand should connect to the spray gun for grounding of his body. Use of special conductive gloves is recommended.



Fig 7.3 (i): Latex gloves for painting



Fig 7.3 (ii): Gloves for component handling non-skid

2. Masks

- Solvent mask - Dry charcoal network is used as filter in mask used with cartridge or pre-filtered
- Powder mask - It is used while feeding and it is not efficient than solvent mask



Fig 7.3 (iii): Worker with a paintmask

3. Ear plug/Muff

- Ear plugs are used to protect ears when large sounds are produced
- Ear plus- it can be used for 2 hours
- Non-disposable ear muffs - these can be reused after washing with water



Fig 7.3 (iv): Ear plugs

4. **Eye shield**

- Eye shield must be used while spraying and working with dust and powder.
- Eyewash bottle is also used.
- An eye shield can be used for 8 hours



Fig 7.3 (v): Eye shield

5. **Industrial barrier cream**

It should be used before work on hand so that any paint can be removed easily.

6. **Renal hands rub cream**

It is used after work to remove paint on hands.

7. **Head guards and steel toe shoes (safety shoes)**

They are used while working on the shop floor.



Fig 7.3 (vi): Safety precaution chart

Notes



UNIT 7.4 Handling of Coating Materials and Equipment as per Safety and Environmental Standards

Unit Objectives

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

1. State how one can practice safe handling of materials and equipment used in painting and coating

Coatings Materials	Pretreatment Chemicals	Safety actions for fire risk	High temperature environments
<ul style="list-style-type: none"> • Read the MSDS. • Avoid excessive skin exposure. • Wear proper respiratory equipment. • Wear proper clothing and eyewear. • Always follow the manufacturers written procedures. 	<ul style="list-style-type: none"> • Read the MSDS • Avoid skin contact • Wear recommended safety clothing • Maintain good ventilation • Always stay alert while handling chemicals 	<ul style="list-style-type: none"> • Eliminate sources of ignition • Maintain a safe concentration of powder/ solvent vapour in air- below 50% of the lower explosion (flammability) limits • Maintain a good ground throughout the racks • Maintain a good ground on everything in the electrostatic coating application system 	<ul style="list-style-type: none"> • Allow the temperature to attain the room temperature before carrying out any work • Disconnect power before entering • Use good lighting when entering • Wear a hard hat in areas where it is necessary to stoop • Never open washer or oven during operation • Know the hazards inside the equipment

Other than the above mentioned, basic elements of combustion such as electrical equipment, matches and cigarettes should be eliminated from site.

Notes

UNIT 7.5 Precautionary Measures

Unit Objectives



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

1. Learn about 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 kinds of safety signs

7.5.1 Ergonomic Lifting, Bending or Moving Equipment and Supplies



Fig 7.5.1 (i): Correct lifting techniques (worldartsme.com)

7.5.2 First Aid



A well-stocked first aid kit is a must at the workplace. It is essential to check the kit regularly and have items such as medications, emergency phone numbers, allergy details of employees and medical assistance numbers in the first aid kit. All expired and out-dated medication should be discarded.

As per Red Cross recommendation, following articles must feature in a first aid box

- 2 absorbent compress dressings
- 25 adhesive bandages (assorted sizes)
- 1 adhesive cloth tape
- 5 antibiotic ointment packets
- 5 antiseptic wipe packets
- 2 packets of aspirin
- 1 blanket
- 1 breathing barrier (with one-way valve)
- 1 instant cold compress
- 2 pair of no latex gloves (size: large)
- 2 hydrocortisone ointment packets
- Scissors
- 1 roller bandage (3 inches wide)
- 1 roller bandage (4 inches wide)
- 5 sterile gauze pads
- 5 sterile gauze pads (4 x 4 inches)
- Oral thermometer (non-mercury)
- 2 triangular bandages
- Tweezers

7.5.3 Emergency Procedures

On rare occasions, you may experience an emergency while working in a coating plant such as:

- Fire
- Medical emergency
- Armed hold up/robbery
- Bomb threat
- Natural disaster

Find out the emergency procedures and evacuation plan for emergency and obtain information on the evacuation plan of the company. Emergency procedures are reviewed from time to time based on the actual incidents. Remember your safety is of utmost importance in case of any emergency. Please refer to your supervisor/manager for specific information regarding your workplace.

- Evacuation routes and exits are prominently displayed in the building and premises.
- Emergency exits, and evacuation routes must comply with local building codes.

You must know

- Preferred method of reporting
- Evacuation policy and procedures
- Emergency escapes procedures and route assignments
- List of emergency contact numbers inside and outside the facility
- Procedure for employees during shutdown of critical operations

You must locate

- Nearest telephone
- Identified restricted areas
- Fire alarm
- Fire extinguisher and fire blankets
- Safety warning tags and signs



- Raise fire alarm
- Use firefighting equipment
- Understand high level of smoke is a hazard
- Increased smoke can decrease visibility and be toxic
- Take a secure escape route
- Notify appropriate personnel immediately



- Person trained in CPR (Cardiopulmonary Resuscitation) must be contacted
- Dial emergency number to contact hospital and ambulance
- Inform supervisor
- Inform family members

7.5.4 Display Safety Signs

- Learn to respect safety signs
- Learn to display them at appropriate places
- It is crucial for your safety and safety of other people
- Never take safety sign instructions lightly





7.5.5 Safety Checklist

As a paint/powder applicator, for all emergency situations, you must

- Know how to report a safety incident
- Understand the evacuation policy and procedures
- Have access to the list of emergency contact numbers inside and outside the facility
- Understand the procedure for employees during shutdown of critical operations
- Never disconnect hose under pressure
- Not leave pressurised unit unattended
- Never point the spray gun at human body
- Ensure the gun has required trigger guard
- Use electrically conductive hose in airless applications
- Ensure that no ignition source is present when flammable materials are used
- Minimise use of low flash point materials
- Check for adequate ventilation

GENERAL SAFETY	<ul style="list-style-type: none"> • Locate nearest telephone • Identify restricted areas • Locate fire alarm • Locate fire extinguisher and fire blankets • Locate moving objects, cranes, and traffic • Identify and observe safety warning tags and signs • Learn facility alarms, evacuation procedures, and general emergency protocols
LADDERS	<ul style="list-style-type: none"> • Periodically inspect for loose, worn, or damaged rungs • Never carry any tools in hand while climbing • Always face ladder while climbing • Never jump from a ladder • Guard against danger of metal ladder coming in contact with electric power lines • Secure the ladder
SCAFFOLDING	<ul style="list-style-type: none"> • Periodically inspect for damage or deterioration • Ensure scaffolding is plumb and level • Ensure handrailing is provided on all scaffolding • Never ride scaffolding on rollers when it is being moved • Verify inspection tags are valid and in place at all times
POWER TOOLS	<ul style="list-style-type: none"> • Ensure safety guards are fitted and operational • Ensure dust collection systems are operational when working with hazardous materials
ABRASIVE BLAST	<ul style="list-style-type: none"> • Ensure that the following are installed and in working order: <ul style="list-style-type: none"> o Deadman valve o Pressure control valves o Adequate moisture and oil separators o Protective clothing (hoods and gloves) o Filtered and regulated air-supplied respirator • Make certain that: <ul style="list-style-type: none"> o Entire system is grounded, including hoses, operator, and work piece o Hose couplings are wired shut o Abrasive hose is stored in a dry place o Abrasive hose is curved around, not bent at 90° angle o Nozzle is never pointed at human body or breakable object o Abrasive hose is inspected for damage and wear

SPRAY APPLICATION	<ul style="list-style-type: none"> • Ensure no ignition sources are present • Minimise use of low flash point materials • Adequate ventilation must always be provided • Ensure spray booth is clear of exhaust fumes from previous spraying • Ensure no rags become soaked with flammable liquid in spray area
PERSONAL PROTECTION	<ul style="list-style-type: none"> • Goggles and safety glasses must be worn at all times • Regulated air respirator must be used always • Operator must always be positioned upwind of object being sprayed
HOSE AND GUN	<ul style="list-style-type: none"> • Hoses must be inspected periodically for weak and worn spots • Hose connections must be correct and tightened • Hose must never be disconnected or recoupled while under pressure • Pressurised unit must never be left unattended • Gun must be grounded through hose connections • Operator uses electrically conductive hose in airless applications.
TEST EQUIPMENT	<ul style="list-style-type: none"> • Holiday detectors must always be grounded • No volatile substances must be present when high voltage detectors are in use • Equipment must be suitable for the environment in which it is being used, e.g., intrinsically safe in hazardous confined spaces

Tips



- Working in a safe, environmentally clean manner without adversely impacting your health and that of your co-workers is not an option, but a mandatory requirement in any job.
- Be conscious of the health hazards posed by various chemicals and substances you use and learn and practice ways of mitigating them.
- Always learn to respect safety signs.
- Make safe working a habit.
- Never take safety sign instructions lightly.



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CIN No.: U74999MH2015NPL268985

ISBN 978-93-5338-222-3



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