# **TVET CERTIFICATE III IN PAINTING AND DECORATION**





Credits: 10

**Sector: Construction** 

Sub-sector: Painting

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# Learning hours: 100

### **Purpose statement**

This is a core module which describes the performance outcomes, skills and knowledge required to mix paints.

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# Learning Unit 1 – prepare material, tools and equipment

## LO 1.1 – Select materials, tools and equipment

<u>Content/Topic 1 Discussion of paints mixing materials</u>

#### 1.1.1. INTRODUCTION

Paints are liquid composition of pigments and binders which applied to the surface in thin coats dry to form a solid film to import the surface a decorative finish, Apart from giving protection to the base material and plaster surface from weathering, corrosion and other chemical attacks.

#### SOME IMPORTANT TECHNICAL TERMS USED IN PAINTING

**Painting:** is the practice of applying a pigmented liquid that stretches thinly across a surface.

**Consistency:** The resistance of a paint to flow. Paint with high consistency flows slowly; paint with low consistency flows readily.

**Color Retention:** The ability of paint to keep its original color and resist fading.

**Film Formation:** The paint's ability to form a continuous dry film. This process is the result of the water or solvents evaporating and the coming together of the binder particles. A continuous dry film repels water.

**Enamel:** (1) Top coat which is characterized by its ability to form a smooth surface; originally associated with a high gloss, but may also include lower degrees of gloss.

**Hiding Power:** The ability of paint to hide or obscure a surface, color or stain over which it has been uniformly applied. Hiding power is provided by the paint's pigment.

Leveling: The ability of a coating to form a smooth film without brush marks appearing.

**Polymer:** This binder is produced from petrochemical feedstock. The binder's polymer particles are small in size and carried in water. The binder polymers and water mix is known as emulsion.

**PVA (Polyvinyl Acetate):** A colorless, thermoplastic, water soluble, resinous high polymer derived from the polymerization of vinyl acetate with a catalyst; used as a latex binder in certain, generally lower quality water-base coatings.

**PVC (Pigment Volume Concentration):** The ratio of the volume of pigment to the volume of total nonvolatile material (i.e., pigment and binder) present in a coating.



**VOC (Volatile Organic Content):** Any carbon compound that evaporates under standard test conditions. Essentially, all paint solvents except water are VOCs. Federal and state governments are beginning to limit the amount of volatile organics found in paint because of concerns about possible environmental and health effects.

**Drier** – a material that speeds up the drying time of the oil paint. Traditionally, driers were cobalt driers, but now they are often Alykd resin driers.

**Drying time** – how long the paints take to dry. Different oil paints contain different quantities of oil binder, depending on how easily the raw ingredients 'mix in' with the oil. So some paints are fast dryers (such as Burnt umber) and others are slow drying (Ivory black).

**Gloss** – the appearance in sheen of the paint or varnish. For example, Alizarin crimson has a glossy surface when dry.

**Glazes** – the term used for a thin, transparent layer of paint. Glazes are used on top of one another to build up depth and modify colors in a painting. A glaze must be completely dry before another is applied on top.

**Grinding colours** – a process of grinding dry pigment with a binder, usually mixed initially with a palette knife and then mulled down to a thinner, smoother consistency with a glass Muller or marble slab.

**Ground** – a thin layer of paint, applied to a support to make it ready for painting, can be white but I prefer to use a colored ground.

**Lean** – a term used to describe the low oil content in paints and mediums. Thinning with solvent results in lower oil content to the paint mix.

Lean paint – a paint layer or paint that has a reduced oil (fat) content.

**Lining** – a conservation term for placing a new canvas on the back of a deteriorating original oil painting.

#### **1.1.2. PAINT ELEMENTS**

Paint generally is made up of the following constituents:

- i) A base
- ii) A binder
- iii) A Drier
- iv) A pigment
- v) A Solvent or thinner
- I) A Base: is a solid substance in form of fine powder, forming the bulk of a paint. It is generally a metallic oxide. The type of base determines the character of paint and impact the durability to the Surface painted.



Various bases commonly used in paint are:

- ✓ white lead
- ✓ Red lead
- ✓ Oxide of iron
- ✓ Titanium white
- ✓ Aluminium white
- ✓ Litho phone
- ✓ Antimony white

A base in paint provides of an opaque coating to hide the surface to be painted

**ii)** A binder: these are liquid substances which hold the different ingredients of paint in liquid inspension. The binder makes it possible to spread the paint evenly on the surface.

The binders generally used are in various forms of linseed oil, tug oil, nut oil.

**iii)** A drier: are used to accelerate the process of drying and hardening by extracting oxygen from the atmosphere and transferring it to the vehicle.

Drier maybe in the form of soluble driers or liquid drier are finely compound of metal such as cobalt, lead, manganese dissolved in a volatile liquid.

iv) Inert filler: it is an adulterant mixed to replace the base in part and thus reducing the cost of paint. Commonly used fillers are silica, charcoal, powdered chalk, aluminium silicate and barium sulphate etc.

The inert fillers in paint serve the following purposes:

- ✓ Reduce the cost of paint
- ✓ Improve durability
- ✓ Modify the weight
- ✓ Prevent shrinkage and cracking
- v) Colouring pigment: this one is added to the base to have different desired colour.

Pigment can be divided into the following divisions:

- ✓ Natural colours
- ✓ Calcined colours
- ✓ Precipitates colours
- ✓ Lakes
- ✓ Metal powders



The desired colour or tint of the paint may be obtained by using single or combination of the following pigments`

N⁰	Colours or Tints	Pigments	
1	Black	Lamp black, Carbon black, bone black,graphite,vegetable	
		black, ivory black	
2	Green	Paris green, chrome green, green earth	
3	Red	Indian red, Vietnam red ,red lead	
4	Yellow	Chrome yellow, zinc chrome	
5	Blue	Prussian blue, cobalt blue	
6	Brown	Burnt umber, raw umber	

The concentration of pigment in paint is denoted by pigment volume concentration number (PVCN) defined by equation below

 $PVCN = \frac{V1}{V1 + V2}$  Where V1: Volume of pigment in paint and V2: Volume of non volatile vehicle

The durability and gloss of the paint is inversely proportion to the volume of pigment volume concentration number (PVCN)

The following table gives PVCN for paint used for various purposes

N <sup>0</sup>	PVCN Range	Types of paints
1	25 to 40	Paint for prime coats on metal
2	35 to 40	Paint for prime coats on timber
3	28 to 49	Paint for exterior surfaces of buildings
4	35 to 45	Semi-gloss paint
5	50 to 75	Faint paint

vi) Solvents or thinners: Solvents are added to the paint to make it thin so that it can be easily applied on surfaces. It also helps the paint in penetration through the porous surface of the wall background.

The following is the list of thinners for various types of paints:

- ✓ Spirit of turpentine
- ✓ Benzene alcohol
- ✓ Water
- ✓ Naphtha



### 1.1.3. PHYSICAL CHARACTERISTICS OF PAINT

The following are physical characteristics of paint

- ✓ Flexibility: the quality of paint of being easily adapted or of offering many different options.
- Electrical resistivity: Resistivity is a measure of how strongly a material opposes the flow of electric current. A low resistivity indicates a material that readily allows the movement of electric charge. The SI unit of electrical resistivity is the ohm meter (Ω.m).
- ✓ Electrical Conductivity: Conductivity is the reciprocal quantity, and measures a material ability to conduct an electric current. An electrostatic liquid paint has generally a resistivity between 1 and 50 MΩ.cm.
- ✓ Viscosity of paint is a measure of a paint fluid's resistance to flow. It describes the internal friction of a moving paint fluid.

The durability and performance of paint coatings depend on two basic properties: cohesion and adhesion.

- ✓ Adhesion: Adhesion is the strength of the bonds forming between one material and another.
- ✓ Cohesion: Cohesion is the inner strength of a material, and it is determined by the strength of molecular forces in the bulk.

### TYPES OF SOLVENTS

The types of solvents mainly used in paint are:

- ✓ Thinner
- ✓ Water
- ✓ Acetone
- ✓ Xylene
- ✓ Denatured alcohol
- ✓ Mineral spirit
- ✓ Trerpentine

#### **1.1.4. PAINT MIXING INGREDIENTS**

**I) Paint:** Paints are liquid composition of pigments and binders which applied to the surface in thin coats dry to form a solid film to import the surface a decorative finish.

### Normally the paints have the followings functions:

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- 1. It provides a smooth and attractive surface.
- 2. It prevents corrosion in metal structures.

3. It guards the surface against weathering effects of the atmosphere and action by other liquids, fumes, and gases.

4. It is used to give a decorative effect on the surface.

5. It prevents the formation of bacteria and fungi, which are unhygienic and give an ugly look to the wall.

- 6. It prevents decay of wood-work.
- **II) Solvents:** are added to the paint to make it thin so that it can be easily applied on surfaces. It also helps the paint in penetration through the porous surface of the wall background.
  - Content/Topic 2 Description of paints mixing tools and equipment
  - **1.1.5.** Types of mixing tools
- Bucket: a roughly cylindrical open container with a handle made of metal or plastic and used to hold and carry liquids. In paints mixing it hold paints liquid and solvents to mix together by using paint stick or other mixing tools.



✓ Paint stick: It is sanded to a fine finish for great quality wood product. It can be used for mixing or stirring paint.



✓ Putty knife: an implement with a broad flat metal blade used especially for applying putty and for scraping





✓ Trowel: is a heavy-bodied textured finish, available in a range of textures to suit every surface also it used in paint mixing.



Trowel for mix oil paints

✓ Paint scraper: The tool has a flat steel blade and a handle of wood, plastic, or metal. Its uses are many, among them removing wallpaper or paint after they've been softened with heat.



✓ Masking tape: also known as painter's tape is a type of pressure-sensitive tape made of a thin and easy-to-tear paper, and an easily released pressure-sensitive adhesive. It is available in a variety of widths. It is used mainly in painting, to mask off areas that should not be painted.





### 1.1.6. Types of paint mixers

### ✓ Pneumatic Machines

Pneumatic Mixer Usage The special envoy is suitable for mixing paint in air spraying. It is also suitable for mixing other coatings. It is also suitable for homogenizing, dispersing and emulsifying applications in chemical, food, pharmaceutical and cosmetics industries.

#### Examples:

#### - Pneumatic mixer with stand and 5 gallon barrel tank



- 1 gallon air paint shaker





### ✓ Electric machines

An electrically operated paint mixing machine (or paint mixer, for short) has been designed and tested using Solid Works CAD software package. The machine was fabricated from mild steel and stainless steel, and the joining of metal to metal was purely by bolts and nuts, and welding processes.

- Automatic paint colour mixing Machine ,Automatic paint mixing machine





- **Dispenser machine:** Dispenser machine Widely used in mixing, dispersing and dissolving liquid and solid including paint, pigment, ink, pesticide, dye, resin,etc.

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- **Compound mixer:** is a heavy duty mixer made of strengthened steel and it save loads of time mixing and preparing with this great tool, it is a tool that can be immensely handy for professionals and personal use alike. It is designed to help you mix and stir your paint, compound evenly and with ease and a reduced mess.



- Manual lifting paint mixer
- Manual paint mixer







-Plastic mixing colour Machine





- Industrial automatic gyroscopic paint mixer



# LO 1.2 – select type of paint

Content/Topic 1 Discussion on different Classes of paints

Classification of paints are based on Categories and Functions

### **1.2.1. CLASSIFICATION BY CATEGORIES:**

### A. OIL BASED/ ENAMEL PAINT

Oil paint is a type of slow-drying paint that consists of particles of pigment suspended in a drying oil, commonly linseed oil. The viscosity of the paint may be modified by the addition of a solvent such as turpentine or white spirit, and varnish may be added to increase the glossiness of the dried oil paint film.

#### SOME EXAMPLES OF OIL BASED PAINT

✓ Super glossy PAINT: High gloss paint is known for being super shiny and light reflecting, giving it an almost mirror-like look. Most designers would consider it a specialty finish, as it creates such a brilliant sheen.





✓ NC paint: N.C paint is based on Nitrocellulose, specially modified short oil alkyd resin. The system is suitably plasticized contains pigments to produce beige shade. Specifically designed to use as a top - coat & also can be used for refinishing purpose.



✓ Crown Duotone paint: Crown duotone Paints is always looking for ways to satisfy customers by providing high end quality paints and finish. It is with the idea in mind to meet the demand for good quality finish that Crown Paints introduced the Duo-Tone Finish. Duo Tone Finish is an extremely tough and attractive 2 or 3 color silk finish. Duo-Tone finish is all about making your walls look better. Duo-Tone finish is suitable for use in commercial, domestic and industrial buildings. All customer demographics have been considered in introduction of the product. It's not limited to specific walls in a home or office. It is however suitable for use in areas with high traffic where regular cleaning is needed.



✓ Epoxy paint: Epoxy coatings are popular because they provide a quick-drying, tough and protective coating. Unlike traditional heat-cured powder coatings, epoxy coatings are quick

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and easy to apply, making them ideal for a number of applications. For example, they are typically used on concrete and steel to give resistance to water, alkali, and acids.



#### **Characteristics of Oil-Based Paints**

Top quality oil-based paints have excellent adhesion characteristics, which mean they get a tight grip on the surface being painted. And good adhesion is essential for a durable paint job. However, oil-based coatings do tend to oxidize and get brittle over time, which can lead to cracking problems in exterior applications, and yellowing and chipping problems in interior applications.

That said, oil-based coatings are still your best choice in two circumstances:

> when repainting exterior surfaces with heavy "chalking" (chalk is the powdery substance that comes off on your hand when you run it cross the surface)

> when repainting any exterior or interior surface that has four or more layers of old oil-based paint (the number of layers can often be determined by removing some paint chips and examining them)

If you decide to use oil-based coatings, be aware that they are more difficult to apply and clean up after than latex paints. They also take longer to dry - sometimes, 24 hours or more - so you cannot apply a second coat as quickly as you can with latex paint.

Oil-based paints can be used for certain applications within the home - for example, on interior trim. But keep in mind that these paints have noticeably more odor than latex paints. That, combined with the slow dry time, may put your rooms out of service for a short while. If you use oil-based paints, you will also have to use paint thinner to clean up drips and equipment, which means that you must use extra care in handling and disposing of rags.

#### **Advantages of Oil-based Paints**

- Attractive gloss
- Good "leveling" (brush strokes fill themselves in to create a smooth finish)
- > Hard, durable finish

#### **B. LATEX/ EMULSION (WATER BASED) PAINT**

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Water-based latex paints have always been popular with do-it-yourselves and professional painters because of their easy cleanup with plain soap and water. But today's quality latex paints offer significant performance advantages as well.

Compared to oil-based paints, top quality exterior latex paints have greater durability in the form of better color retention and chalk resistance, so they continue to look good for years. Since they do not tend to get brittle as oil-based paints do, they have better resistance to cracking. Latex paints also dry much faster than oil-based paints (typically in one to six hours), which allows you to quickly apply a second coat.

### SOME EXAMPLES OF WATER BASED PAINT

**Vinyl paint:** Vinyl paint is a water-based paint containing vinyl plastic that is designed to stick to surfaces such as siding, floors, plastics and seat covers. The vinyl paint soaks into the surface of the material, becoming part of the original surface. Most vinyl paint is opaque and does not easily come off the surface. However, some surfaces resist the application of vinyl paint. There are many different formulas for vinyl paint, all designed for specific tasks.

There are many different types of vinyl paint. Vinyl paint that comes in gallon drums like traditional house paint is generally used to paint over vinyl covers and soft plastics. It is thin enough to soak into the vinyl, causing it to become part of the original surface. The paint is hard to remove once applied. Vinyl spray paint has a similar purpose. Vinyl siding paint and exterior paint are designed to provide a waterproof coating for the siding and outside of a building that will be flexible and resist chipping. Vinyl paint also comes in small tubes used in paintings and other art projects.



✓ Matt paint: Matt Paint gives a matte finish, and it is a water-based paint with a low reflection of light, it feels slightly rougher to the touch. Matt paint tends to be used on interior walls and ceilings. Matt paint covers imperfections better and doesn't draw attention to lumps and bumps.



✓ Weather guard paint: Dulux Weather guard is a latex exterior paint designed for use on most exterior surfaces, is specially formulated to provide excellent weather resistance, easy application and a quick curing time, resulting in a long lasting, uniform finish. Forming a breathable film that allows moisture vapour to pass through, it prevents the penetration of liquid water with a high resistance to blistering and peeling.



### Advantages of Water-based Paints

- Low VOCs (volatile organic compounds)
- Easy cleanup with water
- > Quick drying
- An elastic, flexible finish resistant to cracking
- Stable color over time, without yellowing

#### Performance Comparison between oil and Latex Paints

Performance	Oil Based		Latex
Durability	Excellent adhesion; adhesion than latex on chalked surfaces	better heavily	Excellent adhesion to most substrates; better elasticity than oil.



Colour Retention	Not as good as latex; more likely to chalk and fade in sunny exposure.	Superior resistance to chalking and fading, especially when exposed to bright sun.
Ease of Application	More difficult to apply due to greater "drag," but goes on heavier for better one-coat hiding and coverage.	Goes on smoothly and evenly, with less brush drag.
Mildew Resistance	Vegetable oil base can provide nutrients for mildew growth; most products contain mildewcide to minimize growth.	Less inherent tendency to grow mildew; mildewcide additives discourage mildew growth, help maintain fresh appearance.
Versatility	Can be used on most materials, but for new concrete, stucco and other masonry, a sealer or pre- treatment is required; should not be applied directly to galvanized metal.	Can be used on wood, concrete, stucco, brick, galvanized metal, vinyl siding, aluminium siding, etc
Odor	Noticeably more odor than latex.	Very little odor.
Clean Up	Turpentine, paint thinner or other solvent.	Simple water cleanup.

### **1.2.2. CLASSIFICATION OF PAINTS BY FUNCTIONS**

➢ Primers and bonding liquids: Adhesive primers generally function to conserve the surface of a material that has to be bonded in a later stage, thus providing more flexibility in the manufacturing process. Generally, adhesive primers can be considered to be a strongly (with organic solvent) diluted adhesive, often combined with a coupling agent such as a silane. They have the main function to wet the freshly prepared surface easily and, after drying or curing, to stabilise the surface until the adhesive is applied (which may take as long as a year).

- Interior paint is formulated to be stain-resistant, cleanable and able to stand up to the rigors of everyday living. Unlike exterior paints, interior paint is created with ingredients that take interior air quality into consideration.
- Exterior paints are formulated to handle outside weather, mildew, chipping and fading. Because of this, exterior paints can often contain chemicals and fungicides that are best kept outside.
- Roof paints Industrial/ protective Automotive

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The range of waterproof roof coatings, sealants and roof paints have been developed and designed to protect and decorate your roof. From waterproof roof coating products for both pitched and flat roofs, to paints that provide joint reinforcement and protection for felt, metal, concrete, timber and many more surfaces. Our waterproof roof paint products can be used on sloped roofs, gutters and flat roofs.

- Road markings paints: Thermoplastic road marking paint, also called hot melt marking paint, is a kind of powder paint. When applied as road surface markings, a hot melt kettle is used to heat it to 200 °C to melt the powder, after which it is sprayed on the road surface. The coating then becomes a hard, polymer line after cooling.
- Metallic paints: Metallic paint, also called metal flake or polychromatic, is a type of paint that is most common on new automobiles, but is also used for other purposes. The small metal flakes included in the paint create a sparkling effect mimicking a metal surface.

(Examples: Lumiere Acrylic Metallic Paint (True Gold), Modern Master Metallic Paint (Warm Silver)

Marine paints: are used for Ferries, boats, ships, other water vehicles, as well as other structures that are generally exposed to water

Here are some of the vital benefits of marine paint:

- ✓ Provides maximum retention of color and gloss
- ✓ Weather resistance, such as degradation due to sunlight, chalking, and yellowing
- ✓ High resistance to chemicals, oil, solvent, and water
- ✓ Resistance to impact and abrasion
- ✓ Fast drying

### LO 1.3 – Perform mixing ratio

• Content/Topic 1 Discussion on calculation of paints mixing ratio

### 1.3.1 Mixing ratio

**Definition:** Ratio is a way of comparing amounts of something. It shows how much bigger one thing is than another. For example:

- use 1 measure of screen wash to 10 measures of water
- use 1 shovel of cement to 3 shovels of sand
- use 3 parts of blue paint to 1 part of white paint

Ratio is the number of **parts** to a mix. For example, the paint mix is 4 parts, with 3 parts blue and 1 part white.



The **order** in which a ratio is stated is important. For example, the ratio of screen wash to water is **1:10**. This means that for every 1 measure of screen wash there are 10 measures of water.

Mixing paint in the ratio 3:1 (3 parts blue paint to 1 part white paint) means **3** + **1** = **4** parts in all.



3 parts blue paint to 1 part white paint =  $\frac{3}{4}$  blue paint to  $\frac{1}{4}$  white paint.

If the mix is in the right proportions we can say that it is in the correct ratio.

#### Function

A mix ratio for a two component epoxy or urethane coating is the ratio used **to determine the amount of resin and catalyst** (also referred as hardener or curing agent) required to obtain a full cure of the coating.

#### 1.3.2. Calculation of mixing ratio formula

- > Paint measuring ratio by mixing graduated stick
- > Paint mixing ratio by using graduated container
- Paint reduction recommendation
- Paint reduction equivalent
- Measuring and mixing utilizing a Graduated Container (Volume).

Mixing ratios can be stated either in parts or percentages, parts (normally by volume) being the most commonly used and easiest to understand

When a mixing ratio is given in parts, the measurement chosen as one part can vary greatly. For example, one tea spoon could be used to measure one part, or one 55 gallon steel drum could be used to measure one part. Regardless of size, the chosen measurement must remain the same throughout the mixing process. A mixing ratio given as **4:2:1** normally means **4 parts of base product, 2 parts thinner/reducer, and 1 part hardener.** However, some paint manufactures add hardener second, and thinner/reducer last.

When a mixing ratio is given as a percentage, convert the percentage to a fraction, then think of the fraction as parts solvent/parts paint. Examples of this type of mixing ratio are best illustrated below on the Reduction Recommendations Chart. For instance, the 33% listed in the chart would be 1/3 or one part solvent (thinner/reducer) to three parts paint.

### Measuring and mixing utilizing a Mixing Stick (Volume)

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1) The base product has a mixing ratio of <u>4: 2: 1</u>

2) The container has a flat bottom and parallel sides.

✓ Insert mixing stick into the container and hold vertically.

 $\checkmark$  Pour base product to line below 4 (select graduations that provide the volume of material needed).

✓ Add thinner / reducer to line 6 and then stir.

✓ Add hardener to line 7, and then stir.



### > Measuring and Mixing utilizing a Graduated Container (Volume)

#### Assumptions:

1) The base product has a mixing ratio of <u>4: 2: 1</u>

2) Using an 8 ounce container graduated in one ounce increments.

- ✓ Pour base product to line 4.
- ✓ Add thinner / reducer to line and then stir.
- ✓ Add hardener to line 7, and then stir.





#### **Reduction recommendation chart**

PERCENTAGE	FRACTION	AMOUNT OF THINNER / REDUCER	AMOUNT OF PAINT
25%	1/4	1 part	4 part
33%	1/3	1 part	3 part
50%	1/2	1 part	2 part
75%	3⁄4	3 part	4 part
100%	1/1	1 part	1 part
125%	5/4	5 part	4 part
150%	3/2	3 part	2 part
200%	2/1	2 part	1 part

Reduction percentages can become confusing. Areas where problems may arise include the following:

> 50-50 may mean 50% to the painter, but in reality is 1 to 1 or 100% reduction.

25% solvent 75% paint may mean 25% reduction to the painter, but is actually 33% - 1 part solvent, 3 parts paint.

The same confusion can occur with the remaining percentages. It must be understood that the volume

of unreduced base product is always multiplied by the percentage of reduction to equal the amount of solvent to be added.

### ✓ Paint Reduction Equivalent Chart

<u>Percent</u>	<u>Paint</u>	<u>Reducer or Thinner</u>	<u>Paint</u>	<u>Reducer or Thinner</u>
12 - 1/2%	8	1	1 gallon	1 pint
25%	4	1	1 gallon	1 quart
33 - 1/3%	3	1	1 gallon	1 - 1/3 quarts



40%	5	2	1 gallon	3 pints
50%	2	1	1 gallon	2 quarts
75%	4	3	1 gallon	3 quarts
100%	1	1	1 gallon	4 quarts
125%	4	5	1 gallon	5 quarts
150%	2	3	1 gallon	6 quarts
200%	1	2	1 gallon	8 quarts

# Learning Unit 2 – Perform mixing

# LO 2.1 – Perform mixing

<u>Content/Topic 1. Discussion on preparation of paint mixing workplace</u>

### 2.1.1. CONDITIONS OF A SAFE MIXING PAINT AREA

#### A. CLEAN THE WORK AREA AND TOOLS

Cleaning is the removal of all visible hazardous in an approved way with the use of mechanical and chemical action or both, so that all areas and tools are cleaned and sanitised to a high standard.

There are many reasons why we clean but the most important ones are Health Regulations

Use an automated gun cleaner also saves you money and improves health and safety in your shop. These devices help you get the most mileage from your cleaning solvent, reduce shop waste, and minimize your contact with hazardous solvents.

#### **B. PREPARE TOOLS AND EQUIPMENT**

All paints mixing tools and equipments should be available, well arranged and maintained before starting paint mixing operations.

Maintenance is the upkeep of all tools and equipment to an exacting standard so that all it look consistently new and pristine.

#### C. PREPARE MATERIALS

Mix only the amount of paints and coatings you need. High-volume, low-pressure (HVLP) spray guns, recommended for all painting tasks (and required by law in certain areas),



transfer paint much more efficiently than conventional guns; the result: you use-and need to mix-far less paint.

### D. APPLY SAFETY MEASURES

### keep all containers covered

An open container of paint or solvent contaminates the air. By putting a lid on it!—you will keep harmful vapors out of the air that you and your co-workers breathe. You'll also save materials and money by not letting your expensive paints and coatings evaporate away or are ruined by exposure to air.

### install a ventilation system in mixing room

Inadequate ventilation, common in many paint mixing rooms, poses a serious health and safety risk. A well-designed ventilation system will pull harmful vapours away from you and significantly improve air quality in the mixing room.



### > Wear correctly personal protective equipment (PPE)

Include: air-purifying respirators, chemical-resistant gloves, eye protectors etc...

# LO 2.2 – select mixing method

<u>Content/Topic 1 Discussion of Method and purpose of paint mixing</u>

### 2.2.1. PAINT MIXING METHOD

There are two types of **color mixing**: additive and subtractive. In both cases, mixing is typically described in terms of three color and three secondary colors (colors made by mixing two of the three primary colors in equal amounts). All primary colors combined make an orange/brown shade.

### > Additive mixing

Additive color mixing is creating a new color by a process that adds one set of wavelengths to another set of wavelengths. Additive color mixing is what happens when lights of different wavelengths are mixed. When we add all of the different wavelengths of sunlight, we see white light rather than many individual colors. It is called additive because all of the wavelengths still reach our eyes. It is the combination of different wavelengths that creates the diversity of colors.

Additive color mixing can be illustrated with colored lights.

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A simulated example of additive color mixing. Additive primaries act as sources of light. The primaries red, green, and blue combine pairwise to produce the additive secondaries cyan, magenta, and yellow. Combining all three primaries (center) produces white.

#### Subtractive mixing

Subtractive color mixing occurs when we mix paints, dyes, or pigments. When we mix paints, both paints still absorb all of the wavelengths they did previously, so what we are left with is only the wavelengths that both paints reflect. It is called subtractive mixing because when the paints mix, wavelengths are deleted from what we see because each paint will absorb some wavelengths that the other paint reflects, thus leaving us with a lesser number of wavelengths remaining afterward.

So, the difference between additive and subtractive color mixing is that additive color mixing is what happens when we mix lights of different colors whereas subtractive color mixing occurs when we mix paints or other colored material.



A simulated example of (idealized) subtractive color mixing. An external source of illumination is assumed, and each primary attenuates (absorbs) some of that light. The standard subtractive primaries green, violet/purple, and yellow combine pairwise to make subtractive secondaries red, yellow, and blue (which are additive primaries, or in practice somewhat darker and less-saturated versions of typical additive primaries). Combining all three primaries (center) absorbs all the light, resulting in black. For real pigments, the results would be somewhat complicated by opacity and mixing behavior, and in practice adding a fourth pigment such as black may be helpful.

### 2.2.2. PURPOSE OF MIXING

**Dilution: (Solvents-paint)** : is adding solvent to the paint before you apply it. All Paints products are concentrated and must be diluted with water or other solvents to application.

**Secondary color** : ( paint- paints) If you combine two primary colors with each other, you get a so-called secondary color. If you mix red and blue, you get violet, yellow and red become orange, blue and yellow become green. If you mix all the primary colors together, you get black.

### 2.2.3. TYPES OF PAINT MIXING METHODS

**1. Manual mixing:** Manual mixing is a method to prepare homogeneous paint mixtures by using hand mixing tools. Manual mixing is also convenient for mixing small volumes.

**2. Machine mixing:** Machine mixing is a quick method to prepare homogeneous paint mixtures by using pneumatic or electric paint mixing machines. Machine mixing is also convenient for mixing large amount of paints.

# LO 2.3 – Apply mixing techniques

<u>Content/Topic 1 Discussion of colors classifications</u>

### **2.3.1.** Classifications of colors

1. Five basic colours in painting are:

- ≻ Red
- Yellow
- > Blue
- > White
- black



The colours are classified as primary colours, secondary colours, and intermediate or complementary colours.

### 2. Primary Colours



### **Colour Mixing Chart:**

One of the most exciting things about kid's paints is learning how to mix colours to make new colours. You can use the primary colours red, blue, and yellow to get all of the colours of the rainbow. Plus you can use black and white for shading and lightening colours. This colour mixing chart shows how the 3 primary colours can be mixed with each other to become secondary colours. How these secondary can become intermediate colours.



COLOURS OF		1.000
	PD MAKE PAINPOW	SET
COLOUR	SETC	JEI
DESCRIPTION AND COLOURS OF CAL	RDS REQUIRED WITH	Maste
-1 RED and 1 VELLOW -	make ORANGE	Colour
-1 RED and 9 YELLOW-	make It ORANGE	
2 RED and 1 VELLOW	make Dk ORANGE	
-1 RED and 1 RUIE	make DK. ORANGE	-
-1 RED and 2 BLUE -	make Dk PURPLE	
2 RED and 1 RUIE	make It PIIRPIE	
	make Lt. FORFLE	tis_
- 1 YELLOW and 1 BLUE-	make GREEN	
-1 YELLOW and 2 BLUE	make Dk. GREEN-	
2 YELLOW and 1 BLUE -	make Lt. GREEN-	
-1 BLACK and 1 WHITE -	make GREY	and a
2 RED and 1 BLACK —	make Dk. RED —	
-1 RED and 1 WHITE	make PINK	
2 YELLOW and 1 BLACK -	make BROWN	
2 BLUE and 1 BLACK	make Dk. BLUE -	122
-1 BLUE and 1 WHITE	make Lt. BLUE-	
-1 RED -1 YEL" 1 BLUE	make BLACK	

# 3. Secondary Colours

Results from mixing the Primary Colour with each other.

# Examples:



### 4. Intermediate Colours

Mixing one Primary Colour + One Secondary makes an intermediate colour.



Examples:

Tints: In color theory, a tint is a mixture of a color with white, which increases lightness.

A tint is when an artist adds a colour to white to create a lighter version of the colour. An example of a tint is pink. Pink is a tint created by adding white to red.

A shade: shade is a mixture of a color with black, which increases darkness.

For example, red + black = burgundy

Both processes Tints and shade affect the resulting color mixture's relative saturation.



**Grey or gray**: is an intermediate color between black and white. It is a neutral color or achromatic color, meaning literally that it is a color "without color," because it can be composed of black and white. It is the color of a cloud-covered sky, of ash and of lead.



#### Black +white =grey



Full understandings for color mixing oil paints with examples and instructions for mixing are explained in color mixing table. The table is painted in detail how and what colors to mix to get different colors. The table will expand the horizons and add a daring young artists to mix colors, as for the color you need to mix a few colors and 4 types 2-3 for a shade.

Color	The required color	The main color + mixing Instructions
	Pink	White + add a little red
	Light chestnut	Red + add black or brown and white
	Royal red	Red + add blue
	Red	Red + white lightening, yellow to get orange-red
	Light orange	Yellow + add red a little white
	Golden	Yellow + little red or brown
	Yellow	Yellow + white lightening, red or brown for dark shades
	Pale green	Yellow + add blue / black for the depth
	Grass green	Yellow + add blue and green
	Olive	Green + add yellow
	Light green	Green + add white / yellow
	Turquoise-green	Green + add blue
	Bottle green	Yellow + add blue
	Coniferous	Green + add yellow and black
	Turquoise blue	Blue + to add a little green
	White-blue	White + add blue
	Wedgwood blue	White + blue, and add a little black
	Royal blue	Blue + black, and add a little green
	Dark blue	Blue + Black, and add a little green
	Gray	White + add a little black
	Pearl grey	White + black add a little blue
	Medium brown	Yellow + add red and blue, white lightening, black to dark.
	Red-brown	Red and yellow + add blue and white to lighten
	Golden brown	Yellow + add red, blue, white. More yellow for contrast
	Mustard	Yellow + add red, black and a little green
	Beige	Brown and gradually add white to give a beige color. Add yellow for brightness.
	Off-white	White + add brown or black

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Color	The required color	The main color + mixing Instructions	
	Pink-gray	White + little red or black	
	Blue-gray	White + add light gray + a bit of blue	
	Green-gray	White + add light gray + a bit of green	
	Charcoal-grey	White + add black	
	Lemon-yellow	Yellow + add white, a little green	
	Light-brown	Yellow + add white, black, brown	
	The color green fern	White + add green, black and white	
	Color of forest green	Green + add black	
	Emerald-green	Yellow + add green and white	
	Light green color	Yellow + add white and green	
	Aquamarine	White + add green and black	
	Avocados	Yellow + add brown and black	
	Royal purple	Red + add blue and yellow	
	Dark purple	Red + add blue and black	
	Tomato red	Red + add yellow and brown	
	Mandarin orange	Yellow + add red and brown	
	Reddish-brown	Red + add brown and black	
	Orange	Orange add brown	
	Burgundy-red	Red + add brown, black and yellow	
	Raspberry	Blue + add white, red and brown	
	Plum	Red + add white, blue and black	
	Chestnut	Yellow + add red, black	
	The color of honey	White, yellow and dark brown	
	Dark brown	Yellow + Red, Black and White	
	Copper-gray	Black + add the white and red	
	The color of the eggshell	White + yellow, a little brown	
	Black	Black. Use black as pitch, or brown+blue+red.	

Color mixing table always tell how to mix oil paints for painting, this table should be available to every Artist!

<u>Content/Topic 2 Description of paint mixing techniques</u>

### **2.3.2. MIXING TECHNIQUES**

**A. Mixing on palette**: An artist palette is the surface upon which you squeeze out and mix the paint. Traditionally, an artist's palette was a wooden board with a hole for the thumb,

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so that artists could hold it whilst painting. These days, palettes come in all different sizes and shapes and are made from all kinds of different materials! Each has their pros and cons, and every artist will have a different opinion about which one they prefer.



Read through the descriptions below to get an idea of the different artist palette options:

- ✓ safety glass (favorite type of artist palette)
- ✓ plexiglass
- ✓ real glass
- ✓ white plastic
- ✓ clear acrylic plastic
- ✓ disposable palette paper
- ✓ "Stay-Wet" palettes
- ✓ traditional wooden
- ✓ temporary makeshift "palette"

Also check out tips for keeping your artist palette and paints moist. Acrylic paint dries very quickly, so it's important to make sure they don't dry out!

### Tips for keeping your artist palette and paints moist

The thing about acrylics is that they dry pretty quickly. Therefore you'll need to take measures to keep the paints moist and usable. Here are two options for doing so:

### Atomizer Bottle



This is what we use to keep acrylic paints from drying out. I fill this little atomizer bottle with water, and every so often I give my palette a spray.

The bottle creates a fine mist that spreads evenly across the paints on my palette. I love it! It keeps the paints moist without drowning them.

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I highly recommend having one of these bottles on-hand if you paint frequently with acrylics.

### Liquitex Palette Wetting Spray



Another option for keeping your paints and palette moist is Liquitex Palette Wetting Spray.

This spray not only keeps your acrylic paints moist; it also slows the drying time of acrylic paints and makes it easier to blend colors, working in much the same way as Acrylic Glazing Liquid and Acrylic Retarder.

**B.** Mixing wet into wet One technique all painters should try at some point is wet into wet. That is, intentionally mixing all colors on the canvas and none on a palette, essentially using the canvas as a palette.

Painting wet into wet has several benefits .speed, economy, variety and painterliness.

It's important to note that while this technique can be used with any painting medium, it works best with paints that dry slowly. Oils are obviously a great choice, but acrylics can also be used if a slow drying medium.

**C. Wet-on-wet or direct painting**: Is a painting technique in which layers of wet paint are applied to previously administered layers of wet paint. Used mostly in oil painting, the technique requires a fast way of working, because the work has to be finished before the first layers have dried.

**D. Glazing:** is putting a dark, pure color over a lighter area to make the color more intense. To make a glaze, mix a thin wash of color using a lot of medium to achieve the consistency of watercolor. Alizarin Crimson, Ultramarine Blue, or Indian Yellow makes very nice glazes.

**E. Scumbling:** is taking a light opaque color–such as white, yellow ochre or Naples yellow–and putting it over a darker color using a thin layer. Scumbling gives a painting an airy effect. To be considered scumbling, you do not need to dry brush, but it does need to be a thin layer of paint.



**F. Optical mixing:** Optical mixing is when Impressionist painters place pure colors side by side on canvas, not by mixing them on the palette. In contrast, their predecessors overlaid colors through glazing techniques.

**G. Sgraffito:** (noun from Italian means "scratched"), in the visual arts, a technique used in painting, pottery, and glass, which consists of putting down a preliminary surface, covering it with another, and then scratching the superficial layer in such a way that the pattern or shape that emerges is of the lower colour. During the middle Ages, especially in panel painting and in the illumination of manuscripts, the ground was often of gold leaf. In wall painting, or mural painting, two layers of different-coloured plaster are usually employed.

# LO 2.4 – Test paint mixture

### • <u>Content/Topic 1 Discussion of paint mixture test</u>

### 2.4.1. Purpose and method of Paint mixture test

Paints and their allied products like varnishes, enamels, pigments, printing inks and synthetic resins protect assets from corrosion. These are increasingly being used in automotive and engineering. Paint testing can be done in a number of different ways. The fact of the matter is that many industries use several different paint testing methods in order to ensure accurate results. Paint should be tested in a wet form for particular properties but also in the dry form. Testing of paints generally falls into three categories: testing of the raw materials, testing of the finished product and performance testing using accelerated weathering and other simulation type methods of evaluation.

The aims of the current study were to test the validity of the concentration addition (CA) and independent action (IA) calculation methods for mixture toxicity as well as the reach guidelines for mixture exposure scenarios for paint products.

### 2.4.2. CHARACTERISTICS OF PAINT MIXTURE TO BE TESTED

### 1. Adhesion

In the paint and coating industries, paint adhesion testing is often used to determine if the paint or coating will adhere properly to the substrates to which they are applied. There are several different tests to measure the resistance of paints and coatings from substrates: cross-cut test, scrape adhesion, pull-off test, and others.

### > The scrape adhesion test

The scrape adhesion test measures the determination of the adhesion of organic coatings when applied to smooth, flat panel surfaces. It is helpful in giving relative ratings for a number of coated panels showing significant differences in adhesion. The materials being tested are applied at uniform thickness to flat panels, mainly some sort of sheet metal. When the



materials have dried the adhesion is determined by pressing panels under a rounded stylus that is loaded with increasing amounts of weight until the coating is removed from the substrate surface.

### Pull -off test

The adhesion of a coating or several coated sample of any paint product is measured by assessing the minimum tensile stress needed to detach or rupture the coating perpendicular to the substrate. Unlike the other methods, this method maximizes 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, or a previously specified value is reached

### The cross-cut test

The cross-cut test is a method for determining the resistance of paints and coatings to separation from substrates by utilizing a tool to cut a right angle lattice pattern into the coating, penetrating all the way to the substrate.

A quick pass/fail test can be accomplished through this method. When testing a multi-coat system, determination of the resistance to separation of different layers from one another can be accomplished.

### 2. Flexibility tests for Paints

When a paint or coating is applied on a substrate, then it has top bend along with the motion of the substrate. This might stretch the coating to an extent that it may develop cracks on the paint surface. This development of cracks on the surface is not good for both the appearance and the safety of the substrate.

In order to ensure that the paint does not cracks when the substrate is bent nominally, the manufacturers need to test the flexibility of the paints and coatings they manufacture. There are different types of substrates on which the paints and coatings are applied for different pursues. One of the most commonly used substrate for application of coatings is the metallic products. The metallic surfaces experience more bending as compared to other substrates hence the paints that are meant to be applied on the metallic surfaces must be checked thoroughly for their flexibility so that they could stay on the substrate for a long time. The instrument that can be used for this type of testing is the <u>conical mandrel bending tester</u>.

### **Conical Mandrel Bending**





The conical mandrel bending tester is a testing instrument which can be used for bending a test sample to the desired level to test the flexibility of the test sample. The instrument works on the principle that when a surface is bent to an extent then the coating applied on that surface is also bent which causes the coating to crack. The instrument is best for determining the amount of bending that the coating may bear without developing the cracks on it.

#### 3. Impact resistance

The paints and coating are used on a large number of products to enhance the elegance and appearance of the products. Various types of coatings such as varnish, paint, conversion coatings and other paint products are usually subjected to the different types of damages during the manufacturing process and its use. Therefore, it is necessary to **test the impact resistance of paints** to determine its strength and quality.



#### How to Perform the Impact Test?

The organic coatings that are placed under test are coating on thin metal plates and placed to perform four or more test to measure the results accurately. After the effect of impact forces, when the coating curved, a standard amount of weight is dropped from a height to strike the material that deforms or destroy the coatings and the material as well. The indentation can be either extrusion or intrusion. Steadily increasing the distance, drop down the weight from generally 1inch or 25mm at a time so that the quality of the material can be determined from the set point at which machine is set and failure occurs.



### Types of Impact Test

There are two kinds of test that are performed to determine the impact resistance of paints:

- Weight falls on a punch which is set on the coated metal sheet also known as Indirect Paint Impact Test
- Weight attached to a punch falls on coated metal sheets directly also known as Direct Impact Test

In both the test methods, the damage which is caused by first observed thoroughly and the quality is then evaluated. These highly standardized methods are used to measure the performance of paints and coatings under quick deformation process.

### 4. Abrasion resistance

Those are some method used to test abrasion of paint coating

- Air Blast Abrasive
- Falling Abrasive

#### > Air Blast Abrasion Test

#### "Standard Test Method for Abrasion Resistance of Organic Coatings by Air Blast Abrasive"

This Method covers the determination of the resistance of organic coatings to abrasion produced by an air blast of abrasive on coatings applied to a plane, rigid surface, such as a metal or glass panel.

An abrasive propelled by a controlled air stream is allowed to impinge on a coated panel until the substrate beneath the coating becomes visible. The amount of abrasive used per unit film thickness is reported as the abrasion resistance of the coating. Since the abrasive flow is facilitated with an air blast, the abrasion rate is markedly greater than that obtainable with a free-falling abrasive.

### Falling Abrasive test

### Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive"

It measures the resistance of organic coatings to abrasion produced by abrasive falling onto coatings applied to a plane rigid surface, such as a metal or glass panel. The abrasive is allowed to fall from a specified height through a guide tube onto the coated panel until the substrate becomes visible. The amount of abrasive per unit film thickness is reported as the abrasion resistance of the coating on the panel. Both silica sand and silicon carbide can be used.

### 5. Electrical resistivity or conductivity



ISO 15091:2012 specifies a method for determining the electrical conductivity and the electrical resistance of coating materials. The conductivity is usually measured for waterborne paints and varnishes, including electrodeposition coating materials, and the resistance is usually measured for solvent-borne paints and varnishes. If required, the resistivity of the coating material is calculated from either of these measurements.

### 6. Viscosity

A fluid's resistance to flow is its <u>viscosity</u> the ratio of force required to overcome internal friction between layers of fluid (shearing stress) to the change in speed between layers of fluid (velocity gradient). Many quality control measures are based on viscosity. For example, paint needs to be able to spread properly, but should not be dripping off of the brush. Ink must come out of a nozzle in a precise manner.

Technologies used to measure viscosity for various types of fluids include:

- ✓ Falling ball viscometers measure the viscosity of fluids and some units can also measure the viscosity of gases.
- ✓ Viscosity cups use gravity to allow a fluid to flow through an orifice located at the bottom in a precise amount, which can be measured over time to calculate viscosity.
- Consistometers are metal troughs with graduations that measures materials as they flow at an incline under their own weight. These are typically used to measure paint viscosity to ensure conformity to military specifications.
- ✓ Glass capillary viscometers are used mostly with test methods which conform to a particular ASTM. Use them with viscosity baths to maintain a stable temperature.
- ✓ Tuning fork vibration viscometers feature a level of 1% of reading with a high level of accuracy.
- Rotational viscometers accommodate wide ranges well into millions of centipoises and are considered the most versatile type of viscometer. Their digital readout and ease of use also provide a high degree of accuracy.

### 7. Coating thickness

Non-destructive ultrasonic coating thickness gages that are ideal for non-destructively measuring the dry film thickness of paint applied to gypsum board (drywall / sheet rock / wallboard).



Drywall is typically painted with 3 layers (one primer and two paint). Traditionally a destructive test method is used to determine paint thickness. Today, the primary purpose of ultrasonic testing is to non-destructively measure the TOTAL thickness of the paint system, typically in the range of 3 to 5 mils (75 –125  $\mu$ m).

### 8. Surface roughness

**Surface roughness** often shortened to **roughness**, is a component of surface texture. It is quantified by the deviations in the direction of the normal vector of a real surface from its ideal form. If these deviations are large, the surface is rough; if they are small, the surface is smooth.

Roughness plays an important role in determining how a real object will interact with its environment. In tribology, rough surfaces usually wear more quickly and have higher friction coefficients than smooth surfaces. Roughness is often a good predictor of the performance of a mechanical component, since irregularities on the surface may form nucleation sites for cracks or corrosion. On the other hand, roughness may promote adhesion.

Roughness can be measured by manual comparison against a "surface roughness comparator" (a sample of known surface roughness), but more generally a surface profile measurement is made with a profilometer.

#### 9. Surface cleanliness

Grime and dirt are hazards to oil paint surfaces. To remove these impurities, paintings are usually cleaned dry, or wet with surfactants in aqueous medium. To examine the effects of different cleaning methods, paint surfaces were treated dry and wet. Some aqueous cleaning systems can increase craquelure up to five times as much as dry cleaning methods on oil paint surfaces. However, dry methods are not sufficient to completely clean the surfaces. Therefore, modification of aqueous cleaning methods are necessary and include using mild nonionic surfactants, thickening of the solutions used, reduction of contact humidity, and increasing temperature.



#### 10. Glossy

Gloss is an important aspect of our visual perception of objects. The perception of gloss can relate to a product's finish, texture and how a sample is illuminated and viewed. Surfaces with high reflectance are perceived as glossy, shiny or lustrous, whilst less reflective surfaces are perceived as semi-gloss or matt. Gloss can be measured by several different techniques. One of them is by using an optical instrument called a gloss meter. A glossmeter provides quantifiable gloss measurements, expressed as gloss units (GU).

#### How to measure gloss

Gloss is measured by directing a constant intensity light beam, at a fixed angle, on to the test surface and then monitoring the amount of reflected light from the same angle. This specular reflectance is measured using a gloss meter.

#### Different surfaces require different reflective angles.

#### **High Gloss**

Surfaces with a brilliant or highly polished finish reflect images clearly. This distinct

Reflection is caused by the incident light reflecting on the surface in a specular direction.



#### Semi & Matt Gloss

Semi and matt surfaces reflect images less distinctly and with reduced intensity.

On semi or matt surfaces light not only reflects in a specular direction but also is scattered causing the reflected image to appear diffused.



#### Choosing the correct angle for gloss measurement

Gloss measurement is based on the amount of light reflected on the surface relative to a polished glass reference standard, measured in Gloss Units (GU). The amount of light that is reflected on the surface is dependent on the angle of incidence and the properties of the surface.

Gloss is categorised as either matt, semi or high gloss. In order to determine the most appropriate measurement angle start with a gloss meter set at a 60° angle of incidence.



If the result is between 10 - 70GU, the coating is termed 'semi-gloss' and should be measured using the 60° angle on the gloss meter. If the result is less than 10GU, the product is 'low gloss' and should be measured using the 85° angle on the gloss meter and if it is greater than 70GU, the product is known as 'high gloss' and should be measured using the 20° angle on the gloss meter.

All three angles should be recorded (20, 60 & 85°) when measuring gloss on anodised metals to ensure a complete understanding of the specular reflectance between the coating and the metal substrate.

Gloss Range	60° value	Measure with
High Gloss	> 70GU	20°
Semi Gloss	10 - 70GU	60°
Low/ Matt	< 10GU	85°

#### 11. Porosity

A porosity test expresses either the number of pores in a coating or the area of substrate exposed through pores in the coating. The function of a porosity test is to examine the quality of an applied coating. It is usually a destructive test.

The porosity of a paint film is closely related to the important practical characteristics of stain resistance, abrasion resistance, durability, and the hold-out of any paint subsequently applied.



This test provides a precise means for evaluating and comparing the quality of paint films, insofar as it pertains to porosity as determined on a coating applied to a nonporous substrate. Porosity measured using this test method may *not* be an accurate predictor of coating porosity when the coating is applied to substrate of higher absorption characteristics.

#### Scope of the test

This test method is applicable to air-dry architectural coatings of any type, both solvent and water-borne, and of any color, dark as well as light. It cannot be used with films that are dissolved or excessively softened by mineral oil, but practical examples of such films will be encountered rarely.



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