Chapter 36: Wall Finishes – Painting: Types, Materials, Durability

1. Introduction to Wall Finishes

Wall finishes are applied to interior and exterior wall surfaces for functional, aesthetic, and protective purposes. Among the various finishes available, **painting** is the most widely used due to its cost-effectiveness, versatility, and wide range of applications.

Wall paints not only enhance the appearance of a structure but also serve to protect surfaces from moisture, weathering, fungal growth, corrosion, and wear and tear. The selection of appropriate paint, preparation techniques, and application methods is crucial to achieving durability and desired performance.

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2. Types of Paints

The classification of paint is generally based on:

- **Base material (oil, water, synthetic)**
- **Finish (glossy, matte, satin)**
- **Application area (interior, exterior, industrial, etc.)**

2.1 Oil-Based Paints

- **Composition**: Pigments suspended in oil-based (alkyd) medium.
- **Properties**:
    - Excellent adhesion
    - Glossy finish
    - Durable against abrasion
- **Applications**: Doors, windows, metalwork, exterior surfaces.
- **Limitations**: High VOC content, longer drying time, yellows over time.

2.2 Water-Based Paints (Emulsion Paints)

- **Composition**: Pigments dispersed in a water-based polymer emulsion.
- **Types**:
    - Acrylic emulsions
    - Vinyl emulsions
- **Properties**:
    - Quick drying
    - Low odour and VOC
    - Washable and UV resistant
- **Applications**: Interior and exterior walls, ceilings.
- **Limitations**: Less glossy, not as hard-wearing as oil-based paints on metal.

2.3 Cement-Based Paints

- **Composition**: Cement, pigments, and water.
- **Properties**:
    - High opacity
    - Breathable (allows moisture to escape)
    - Anti-fungal properties
- **Applications**: Exterior surfaces, particularly cement-plastered walls.
- **Limitations**: Limited colour range, not suitable for glossy finishes.

2.4 Enamel Paints

- **Composition**: Synthetic resins and solvent base with pigment.
- **Properties**:
    - Hard, glossy finish
    - Waterproof
    - Resistant to chemicals and stains
- **Applications**: Metal and wooden surfaces, kitchens, bathrooms.
- **Limitations**: Longer drying time, emits strong fumes.

2.5 Acrylic Paints

- **Composition**: Acrylic resin binders, water-based.

- **Properties**:
    - High UV resistance
    - Retains colour
    - Crack-resistant
- **Applications**: Exterior walls exposed to sunlight.
- **Limitations**: Higher cost.

2.6 Distemper Paints

- **Types**:
    - Dry distemper (powdered form)
    - Oil-bound distemper (OBD)
- **Composition**: Chalk, lime, pigment, glue binder.
- **Properties**:
    - Economical
    - Limited durability
- **Applications**: Low-cost interior walls.
- **Limitations**: Not washable, fades quickly.

2.7 Textured Paints

- **Composition**: Water-based paints with additives like sand, silica, quartz.
- **Properties**:
    - Decorative
    - Hides imperfections
    - Good sound insulation
- **Applications**: Feature walls, ceilings.
- **Limitations**: Difficult to re-paint or touch up.

2.8 Anti-Fungal and Anti-Bacterial Paints

- **Composition**: Water-based or oil-based paints with biocides.
- **Properties**:
    - Prevents mould and mildew growth

    - Suitable for humid areas
- **Applications**: Hospitals, bathrooms, kitchens.
- **Limitations**: More expensive, limited colour options.

2.9 Heat-Resistant Paints

- **Composition**: Silicone resins, ceramic pigments.
- **Properties**:
    - Withstands high temperatures
    - Used on boilers, exhausts
- **Applications**: Industrial walls and surfaces exposed to heat.

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3. Painting Materials

Painting materials can be grouped as follows:

3.1 Pigments

- Provide colour, opacity, and UV resistance.
- Examples: Titanium dioxide (white), iron oxide (red/yellow), carbon black.

3.2 Binders (Resins)

- Binds pigment particles to the wall.
- Determines paint's adhesion, durability, and finish.
- Examples: Acrylic, alkyd, epoxy, polyurethane.

3.3 Solvents (Thinners)

- Adjusts viscosity and aids in application.
- Evaporate after application.
- Water (in emulsions), turpentine or mineral spirit (in oil-based paints).

3.4 Additives

- Improve performance, flow, mildew resistance, drying time, etc.
- Examples: Dispersants, stabilisers, fungicides, anti-foaming agents.

3.5 Primers and Undercoats

- Applied before main paint to improve adhesion and sealing.

- Different primers for concrete, wood, and metal.

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4. Surface Preparation for Painting

Proper surface preparation ensures longer durability and better finish.

4.1 Cleaning

- Removal of dust, dirt, grease, and loose materials.
- For new plaster, surface should cure for 28 days before painting.

4.2 Repairing Surface Defects

- Filling cracks and holes using putty or joint compound.
- Sanding for smoothness.

4.3 Priming

- Applied to enhance paint adhesion and prevent absorption.
- Prevents efflorescence and moisture-related failures.

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5. Application of Paint

5.1 Methods of Application

- **Brush Application**: Traditional, suitable for small areas and detailing.
- **Roller Application**: Common in walls/ceilings, uniform finish.
- **Spray Application**: Fastest, suited for large industrial surfaces or textured paints.

5.2 Number of Coats

- Generally, **one primer + two coats** of paint for best performance.
- Some paints may require more coats for opacity and depth.

5.3 Drying and Curing Time

- Depends on paint type, humidity, and temperature.
- Touch dry in a few hours; full cure may take days.

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6. Durability and Factors Affecting Paint Life

6.1 Expected Lifespan

Paint Type	Average Durability
Emulsion (interior)	5–7 years
Acrylic (exterior)	7–10 years
Cement-based	3–5 years
Enamel	5–8 years
Distemper	2–3 years

6.2 Key Durability Factors

- **Surface preparation quality**
- **Number and quality of coats**
- **Environmental conditions (humidity, UV)**
- **Paint quality and brand**
- **Presence of efflorescence or dampness**
- **Traffic exposure (interior vs. exterior walls)**

6.3 Common Failures

- **Peeling**: Poor adhesion due to moisture or surface contamination.
- **Blistering**: Trapped moisture vapor or heat exposure.
- **Chalking**: UV degradation of binder, leaving powdery surface.
- **Cracking**: Over-thick application or poor substrate movement.
- **Fading**: UV and chemical exposure leading to colour loss.

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7. Testing of Paints

7.1 Adhesion Test (Cross-cut or Pull-off Method)

- Measures the strength of bond between paint and substrate.

7.2 Dry Film Thickness (DFT) Test

- Ensures correct layer thickness using magnetic or ultrasonic gauges.

7.3 Gloss Measurement

- Using gloss meter; expressed in gloss units (GU).

7.4 Washability Test

- Measures resistance to cleaning and scrubbing.

7.5 Resistance Tests

- **Water resistance**, **alkali resistance**, **UV resistance**, etc., using laboratory methods like QUV testing.

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8. Environmental and Safety Considerations

- VOC (Volatile Organic Compounds) emissions can be hazardous.
- Use **low-VOC or zero-VOC paints** for green buildings.
- Proper ventilation is essential during application.
- Protective equipment: masks, gloves, goggles.

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9. Innovations in Paints

- **Nano paints**: Self-cleaning, hydrophobic, UV resistant.
- **Smart paints**: Thermochromic and photochromic paints for changing colours with light/temperature.
- **Eco-friendly paints**: Made with natural oils, resins, and mineral pigments.

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10. Paint Systems and Coating Specifications

In professional construction projects, painting works are executed using **specified paint systems**. A paint system refers to the sequence of coats, type of paint used in each layer, and the thickness of each coat.

10.1 Components of a Paint System

- **Primer coat**: Applied on bare surface to improve adhesion and seal the substrate.
- **Undercoat**: Builds film thickness, enhances opacity, and smoothens surface irregularities.
- **Topcoat**: Final aesthetic and protective layer; defines the appearance and durability.

10.2 Specification Format

Example:

1 coat of alkali-resistant primer + 1 coat of acrylic undercoat + 2 coats of 100% acrylic emulsion (DFT: 100 microns)

Specifications should also include:

- Substrate type (plaster, concrete, gypsum, etc.)
- Surface preparation requirements
- Drying and curing times between coats
- Method of application (brush/roller/spray)
- Brand/grade of paint

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11. Painting Over Different Substrates

Different wall materials behave differently when coated with paint. Each requires specific preparation and paint types.

11.1 Concrete and Cement Plaster

- Surface must be fully cured (28 days)
- Free of efflorescence
- Preferable: cement primer followed by emulsion or acrylic exterior paint

11.2 Gypsum Board / Drywall

- Requires sealing primer to prevent absorption
- Acrylic emulsion preferred
- Avoid oil-based paints which may cause warping

11.3 Wood Surfaces

- Sanding required
- Knots treated with shellac-based primers
- Use oil-based or water-based enamel paints

11.4 Metal Surfaces (e.g., steel supports, grills)

- Surface cleaned to remove rust, scale, oil
- Use red oxide or zinc chromate primer
- Enamel topcoat or epoxy coating depending on exposure

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12. Maintenance of Painted Surfaces

Proper maintenance enhances the life and appearance of painted walls.

12.1 Cleaning

- Use mild soap and water for emulsions and acrylics
- Avoid harsh scrubbing on distempers

12.2 Repainting

- Usually needed every 5–7 years depending on conditions
- Surface needs to be cleaned and may require light sanding and patching

12.3 Spot Repairs

- For minor damages like scratches or stains
- Touch-up may require feathering and colour matching

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13. Painting in Special Environments

Certain structures and spaces require specially formulated paint due to environmental challenges.

13.1 Coastal and Humid Areas

- Use **anti-fungal**, **anti-algal**, and **UV-resistant** paints
- Surfaces must be dry and sealed against salt air exposure

13.2 Industrial Environments

- Require **epoxy**, **polyurethane**, or **chemical-resistant** coatings
- Must comply with fire-resistance and corrosion resistance ratings

13.3 Healthcare and Food Processing

- Use **antimicrobial** and **washable coatings**
- Paints should meet hygiene and safety certifications

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14. Green Building Standards and Paints

In sustainable construction, the choice of wall finishes affects environmental ratings.

14.1 Low-VOC and No-VOC Paints

- VOCs contribute to indoor air pollution
- LEED and GRIHA standards recommend using low-VOC finishes

14.2 Reflective and Cool Paints

- Reflect infrared radiation and reduce surface temperatures
- Contribute to energy savings in buildings

14.3 Paint Recycling and Waste Management

- Leftover paints should be stored safely
- Avoid pouring into drains; use proper disposal or donate

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15. Common Site Issues and Troubleshooting

During construction or renovation, various problems arise due to incorrect painting practices.

15.1 Efflorescence

- **Cause**: Moisture brings salts to surface
- **Solution**: Dry the wall, treat with sealers, reapply paint

15.2 Poor Adhesion / Peeling

- **Cause**: Damp surface, no primer, dust
- **Solution**: Proper surface prep and correct primer use

15.3 Uneven Sheen / Lap Marks

- **Cause**: Poor technique, uneven drying
- **Solution**: Maintain wet edge, use recommended rollers

15.4 Mold and Mildew

- **Cause**: High humidity, water leakage
- **Solution**: Use anti-fungal coatings and fix moisture source

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16. Cost Estimation of Painting Works

Proper estimation helps in budgeting and procurement.

16.1 Factors Influencing Cost

- Type of paint and brand
- Surface area and condition
- Number of coats required
- Labour and application method

16.2 Calculation Formula

Total Cost = Area × Rate per sq.m

Example:

100 m^2 wall × ₹35/m^2 (primer + 2 coats of emulsion) = ₹3,500

Use standard DSR (Delhi Schedule of Rates) or CPWD rates for public works.
