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Coating Problems

by Karen L. Warseck

To understand what makes a coating work, one must understand its composition and formulation. Hundreds of chemicals can be used in various combinations to attain certain desired characteristics, but all coating components can be broken down into two parts, vehicle and pigment. The pigment is the component that hides the substrate and provides color. Pigments can also be added to provide specialized effects such as inhibiting corrosion, controlling gloss, tooth or sag, and reinforcing the cohesion or durability of the film.

The vehicle is comprised of two elements, the solvent and binder. The solvent is the volatile part that gives the coating its liquid form. For example, water is the solvent part of what is commonly (and incorrectly) known as "latex" paint.

The binder, or resin, used gives the coating its generic name – urethane, epoxy, vinyl, alkyd, etc. The binder is used to encapsulate the pigment and is left behind when the solvent evaporates. This becomes the dry film, or what is known as a coat of paint.

The serviceability of this film of binder and pigment depends on selection of the most suitable coating formulation, appropriate and sufficient surface preparation, proper application techniques and timely maintenance. If these are provided, many coating problems can be avoided whether the surface to be covered is a single wood door or dozens of massive steel beams.

The following is a compendium of common paint and coating problems, their causes and cures. Whenever possible, we have also included how to prevent them.

ALLIGATORING

Appearance

- Cracking in a pattern that resembles an alligator's hide. Cracks may extend down to bare substrate.

Cause

- Incompatibility of top coat and underfilm.
- Coating over a soft underfilm.
- Old thick paint that has lost its flexibility.

Remedy

- Remove failed coating, especially if cracking extends to bare surface, and recoat.
- Recoat with a compatible top coat.

chalking caused white stains on brick

Prevention

- Use compatible underfilm and top coats.
- Do not recoat until underfilm is sufficiently cured.
- Remove old thick paint before repainting.

BLUSHING

Appearance

- Whitening of finish.

Cause

- Absorption and retention of moisture formed on film during or immediately after spraying.

Remedy

- Recoat using mist coat of retarder.
- Use slower evaporating reducing thinner when recoating.

Prevention

- Use correct air pressure at spray gun.
- Use a slow evaporating retarder.

(continued)

BUBBLING (BLISTERS)

Appearance

- Bubbles on the surface of the dried film.

Cause

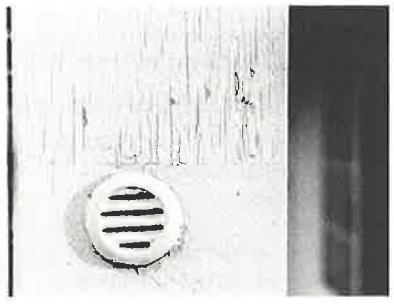
- Rapid evaporation of solvents.
- Air displacement resulting from absorption of wet film into porous substrate.
- Urethanes contact with moisture.
- Water permeating the dry film and reacting with soluble salts or corrosion beneath a film over metal substrates.
- Solvents or air trapped underneath an already skinned over film.

Remedy

- Sand and repaint. If acrylic or vinyl resin, do not break blisters, as they may dry and return to normal. If oil base paint, break blister with a pointed object such as a straight pin and allow film to dry completely before touching up recoat at lower surface temperature.
- Recoat at lower relative humidity.
- Bridge or fill voids by applying a mist coat or a filler or sealer.

Prevention

- Coat only within correct temperature range.
- Use urethanes only when air and surface are dry.
- Hose down concrete and masonry with water and allow to drain before applying water-thinned coatings.
- Add slower evaporating solvent to increase length of time that film is wet.
- Do not paint with acrylic resin or styrene-butadiene paints late in the day or when rain or dew is likely.
- Do not paint in direct sunlight.
- Use high performance, corrosion resistant protective coatings in wet or corrosive environments.



cracking due to swelling and shrinkage

CHALKING

Appearance

- White powder appearing on surface.

Cause

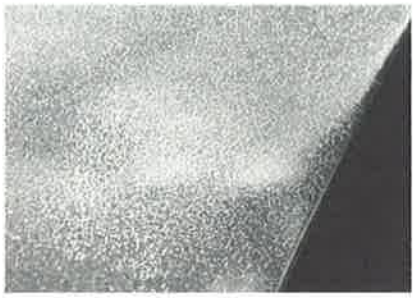
- Erosion of coating.
- Gradual disintegration of the resin in the paint film.
- Too much pigment for the amount of binder.

Remedy

- None. Every coating will chalk to some degree.
- Wash surface with a solution of ½ cup non-ammoniated detergent to one gallon water to remove excessive chalking. Spray rinse.

Prevention

- Minimize by using coatings formulated to resist chalking.
- Do not use chalking paint above dark colored or masonry surfaces to minimize problem.



crazing

CRACKING

Appearance

- Visible cracks through the surface of the film.
- See also alligatoring, crazing.

Cause

- Bending and flexing of non-rigid substrates such as sheet metal.
- Cracking of rigid substrate due to tension and compression.
- Physical damage (impact, heat, exposure, etc.).
- Surface freezing of water-base paints.
- Application of excessive number of coats.
- Too thick of a coat.
- Aging, loss of flexibility of coating.
- Swelling of wood due to moisture penetration.

Remedy

- Sand and recoat, if not severe.
- Remove and refinish if cracks have progressed down to substrate.

Prevention

- Use coating that is elastic enough to withstand repeated bending and flexing.
- Do not paint damp wood.
- Do not apply coating too thickly.
- Remove excessive layers of old coating before recoating.
- Do not apply water-base paints when there is danger of freezing within twenty four hours.

CRATERING

Appearance

- Round U or V shaped thin spots or voids.

Cause

- Breaking bubbles or blisters.
- Water in spray equipment lines.

Remedy

- See "bubbling."
- Correct equipment malfunction, sand surface smooth and recoat.

Prevention

- Be sure equipment is functioning correctly.
- Flush lines before spraying.

CRAZING

Appearance

- Surface cracking in a random pattern.
- Fine line cracking forming a network or overall pattern.

Cause, Remedy, Prevention

- See "Cracking."

(continued)

Journal is a publication of Hoffmann Architects, specialists in investigative and rehabilitative architecture/engineering, including the analysis and solution of roofing, masonry, glazed curtain wall and structural problems. Our offices are located at 3074 Whitney Avenue, Hamden, CT 06518, Phone (203) 281-4440 and 1925 Century Boulevard, Suite 4, Atlanta, GA 30345, Phone (404) 633-7817.

We welcome contributions to HAJ from our clients and friends. Please send news and technical information to Karen L. Warseck, Editor, Hoffmann Architects/Journal at the Atlanta address. Address changes and additions to the mailing list should be sent to Dori Marias in Hamden.

technical notes

DELAMINATION (PEELING) (FLAKING)

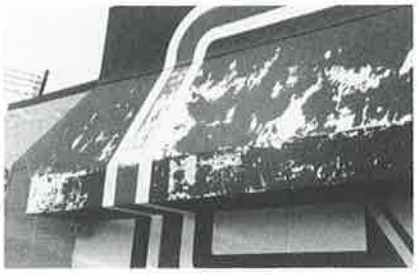
Appearance
- Loss of adhesion to substrate or between coats.

Cause
- Painting over chalking, dirty, oil coated or glossy surfaces. Surface improperly prepared.
- Substrate expands and contracts more than paint film.
- "White rust" formation on unpainted galvanized metal.
- Moisture penetration through porous substrates behind a paint film.
- Incompatibility between topcoat and underlying film.
- Corrosive contamination between coats.
- Undercoat has cured beyond maximum recoat time.

Remedy
- Repair substrate or undercoat condition causing delamination, remove all coating that is not tightly adhered and recoat.
- Use coating that is suitable to substrate conditions.

Prevention
- Properly clean and prepare surface before coating.
- Do not exceed maximum time allowed for recoating.
- Use a top coat that is compatible with the underfilm.
- Repair any water penetration problems prior to coating.
- Use proper primers.

examples of delamination



erosion of topcoat allows basecoat to show

DRY SPRAY (SEE SANDY APPEARANCE)

EROSION

Appearance
- Wearing away of paint layers so that undercoats are visible.

Cause
- Weatering.
- Poor quality paint.

Remedy
- Prepare surface correctly and repaint.

Prevention
- Use more abrasion-resistant and more durable coatings.

FRAMING

Appearance
- Color, texture or hiding variations where roller applied surfaces join work done by brush.

Cause
- Uneven film build between roller and brush work.

Remedy
- Recoat.

Prevention
- Apply heavier coats.
- Apply two coats.

HOLIDAYS

Appearance
- Missed areas in coating.

Cause
- Poor or careless application procedures.
- Difficult to paint construction.

Remedy
- Touch up or recoat.

Prevention
- Use more care in application.
- Use care in design to avoid narrow gaps, sharp or rough surfaces and edges, skip welds, back to back angles or channels and small holes.

LAP MARKS

Appearance
- Color, sheen or texture variations where one freshly painted area overlaps another.

Cause
- First area has set up before overlap was made.

Remedy
- Recoat. .

Prevention
- Work with smaller areas to reduce time between overlaps.
- Adjust coating material and equipment to suit environmental conditions.

LIFTING

Appearance
- Distortion, blisters or formation of wrinkles on the finish.

Cause
- Solvents attacking previously applied film.
- Wax or grease on film surface.
- Use of incorrect thinner.
- Poorly dried undercoat.

Remedy
- Remove grease or wax with appropriate cleaner.
- Remove affected film and recoat.

Prevention
- Allow longer drying time before recoating and use leaner thinner for top coat.

LOSS OF GLOSS (FLATTING)

Appearance
- Flat finish on shiny surfaced coating.

Cause
- Absorption and retention of moisture formed on film during or immediately after spraying.
- Overthinning.
- Use of wrong solvent to thin coating.

Remedy
- Recoat with a mist coat of retarder or a slower evaporating reducing thinner.
- Recoat during drier conditions.

Prevention
- Do not coat when air is humid, surface is damp or danger exists of rain or dew formation.

Thin only in accordance with the manufacturer's recommendations.

(continued on page 6)

services

Representative Projects

Structural Engineering

Our structural engineering department surveyed the existing condition of a two-level underground parking garage at a condominium in Stamford, Connecticut for Plaza Realty & Management Corporation. They also prepared plans and specifications and administered the construction contract for the rehabilitation of an 800,000 square foot parking garage in Danbury, Connecticut.

structural engineer Jane Estey discusses project with architect Amy Kilburn

Jane examines repairs to a precast concrete parking garage

Real Estate Consulting Services

The Atlanta office reviewed the construction documents and is monitoring construction of a shopping center in Arlington, Texas for the Broadview Savings and Loan Company. For the same client, the firm is providing similar services for a 97,000 square foot neighborhood shopping center in Kissimmee, Florida.

A sample of other real estate consulting services include a pre-mortgage survey of an 80,000 square foot office building for The Travelers Companies, a pre-purchase building condition survey of a brick office building for Goldman, Sachs & Company, New York and a pre-mortgage survey of an office building in Stamford, Connecticut for Aetna Realty Investors.

intern architect George Lambert

Facade Rehabilitation

The firm surveyed the exterior masonry and waterproofing at Mount Sinai Hospital in New York City for Davis Brody & Associates, a New York architecture firm. For a private partnership, we examined the glazed curtain walls of two four-story office buildings in Greenwich, Connecticut.

Roofing

Hoffmann Architects prepared bid and construction documents for the reroofing of several Rockefeller Center buildings, including Manufacturers Hanover, Associated Press, International Building and Radio City Music Hall. For Property Management Systems, we prepared plans and specifications for reroofing an office/industrial building in Woodbury, New York,, using a hypalon single-ply membrane system.

Ray Loomis, director of structural engineering, reviews a survey report

If you would like more information on the services we offer, please contact Peter Borgemeister in the Connecticut office or Karen Warseck in the Atlanta office.

Glossary of Coating Terms

Acrylic Resin – Synthetic resin that has excellent water resistance, wet adhesion and hardness.
Activator – Component which when added to a coating, speeds up a desired reaction.
Adhesion – The ability of a coating to bond to the substrate.
Air-Dried – Coatings that normally reach a desired hardness without external heat.
Airless Spray – Method of applying coatings using high fluid pressures; no air for atomization.
Aliphatic Hydrocarbon – Solvent such as mineral spirits and naptha that are used to thin alkyd paints.
Alkali – Term applied to caustic chemicals.
Alkyd – The reaction products of polyhydric alcohols and polybasic acids used as the resin in many industrial enamels. Properties vary widely.
Alligatoring – Pronounced wide cracking over the entire surface of a coating resembling an alligator's hide.


Wrinkling


Checking

Anatase – A tetragonal titanium dioxide used especially as a pigment.
Anodyzing – Generally pertains to an oxide deposited electrolytically on an aluminum surface.
Anti-Fouling – Coating applied to ship bottoms to prevent marine growths. May contain toxic ingredients.
Aromatic Hydrocarbon – Volatile solvents usually extracted from coal tar (such as xylene and toluene) that are used to thin epoxy esters, chlorinated rubber paints, etc. Term refers to chemical composition rather than smell.
Barrier Film – A thin film, usually of oxide or chromate, which is lightly attached to a metal surface and which retards further corrosion.
Binder – The resin portion of coatings whose function is to hold pigments together, and provide a cohesive film.
Bituminous Coating – A water emulsion or solvent cut-back of asphalt or coal tar pitch used as a low-cost waterproofing agent in corrosive environments.
Blast Cleaning – Removal of surface imperfections by means of the high velocity impact of substances such as sand, ice chips, pellets, corn cobs or other abrasive particles, usually propelled by compressed air.
Bleeding – The diffusion of colored matter through a coating from the substrate, also the discoloration arising from such diffusion.
Blister – Raised area of coating surface resembling a bubble.
Block Filler – An undercoat used to fill the large porous voids of concrete, cement or hadite block prior to painting.
Blushing – Hazing or whitening of finish.
Bodying Agent – A substance added to a coating to provide the proper viscosity.
BON Red – An expensive, clean, organic pigment used to produce a bright red color with good bleed resistance.
Bond – Binding force between coating materials and the surface to which they are applied.
Box – To mix a two part coating by pouring back and forth from container to container.
Build – The thickness of a single application.
Calcium Carbonate – An extender pigment used to control sheen, degree of flow, and tint retention.
Carbon Black – A pigment with excellent hiding powers used to make black colors.
Cementitious Coating – A coating using portland cement as the binder material.
Chalking – Form of paint degradation in weather resulting in loose, powdery pigment on surface.
Checking – Breaks or cracks in the film that may or may not penetrate to the underlying surface. See also crazing, cracking, alligatoring.
Chlorinated Rubber – A binder used in solvent-base coatings that resists attack by microorganisms, shows low permeability and adheres well to wood and concrete.
Chlorothalonil – A non-mercurial fungicide which provides excellent mildew resistance in latex paints.
Clear – A coating containing vehicle only and no pigment.
Coalescence – A curing process of acrylic resins where, when the solvent evaporates, the intermolecular attraction of the latex polymers causes the spaces between the molecules to tighten.
Coat – One wet application. Can include several passes, if no drying time is allowed between them.
Coating – A material which is applied in a liquid or gel state and allowed to cure to a solid protective finish. All paints are coatings, but not all coatings are paints.
Cohesion – The ability of a coating to internally bond.
Coil Coating – A specialized method of factory applying a continuous coating to sheet metals while still in coil form. The coating is then oven cured, and the metal shipped in coil form to be fabricated into finished product.
Commercial Blast Cleaning – The lowest degree of blast cleaning in the SSPC specifications. Surface is cleaned better than power tool cleaning, but not as well as white metal blast cleaning.
Conductive Coating – A coating specially formulated to conduct static electricity.
Co-Reacting – Cure method by which molecules of different types cross-link to form the cured film. Oxygen is not necessary to initiate the reaction.


Chalking

Corrosion – Adverse reaction of any material with its immediate environment.
Coverage – The theoretical area that can be covered by a coating film one mil thick.
Cracking – Breaks in the coating that penetrate to the substrate. See also crazing, checking, alligatoring.
Cratering – The appearance of circular domes in the dried film with a thin spot in the center.
Crosslinking – A method of polymerization.
Cross Spraying – Making two passes over the same surface at right angles to each other.
Cure – The method by which a coating solidifies or dries; also, to solidify or dry.
Curing Agent – Activator or hardener added to a synthetic resin to develop proper chemical resistance.
Curtains – Long, horizontal sags in film occurring on vertical surfaces.
Delamination – Separation between coats or the coating from substrate. Also called peeling or flaking.

Cracking

Delamination

Dispersion – Suspension of minute particles in a medium.
Driers – Metallic soaps used to accelerate the drying time of alkyd and epoxy ester coatings. Common types are cobalt, calcium and zirconium soaps.
Dry Film Thickness – Thickness of the coating film after cure.
Dry Fog – A paint which, under normal conditions of application, the overspray falls to the floor as a dry dust without damaging the surfaces on which it has fallen.
Dry To Touch – The point in the cure where the coating is sufficiently cured to feel dry to the touch, but may not be dry enough to handle or recoat.
Drying Oil – A fatty oil capable of conversion from a liquid to a solid by slow reaction with oxygen in the air. Drying refers to a change of physical state, not evaporation.
Eggshell – A coating surface with little gloss, but a fair amount of sheen may be present. Also called velvet.
Elastomeric Coating – A coating with the ability to compress and elongate without failure to plus or minus 25% of its at-rest width.
Emulsion – A mixture of finely dispersed particles in a liquid medium. The particles are not dissolved in the medium.
Enamel – Type of oil-base coating with a high gloss.
Epoxy – Synthetic resin derived from petroleum products that can be cured by a catalyst or formulated to upgrade other synthetic resins to form a protective coating. When cured with amine resins, produces excellent adhesion and chemical resistance properties.
Erosion – Wearing away of paint surface due to weathering.
Ester – Compounds formed by the reaction of alcohols with organic acids; for example, butyl acetate. Includes strong solvents such as butyl acetate or glycol acetate. Commonly used in epoxies for thinning and lower odor.
Etching – Preparing a cleaned or roughened surface by treatment with an acid.
Extender – Inert ingredients in a coating used to increase the solids by volume ratio without adversely affecting the coating's other properties.
Ferrous – Pertaining to a substance containing iron.
Film – A layer of coating or paint.
Flaking – Actual detachment of small pieces of coating in irregular shapes. See delamination.

Flaking

Flat – Coating surface with the least amount of gloss or sheen. See also matte.
Flooding – Pigment that floats to the surface of a film, usually in streaks.
Flow – The viscosity of a coating.
Fluorocarbon – A premium, semi-gloss, factory applied type of coil coating with a life expectancy of over 20 years.
Force-Dried – Application of heat above normal room temperature to hasten drying. Temperature may be as high as 180 degrees, but is below baking temperatures.
Galvanize – To coat with molten metal zinc by dipping.
Gloss – The amount of shininess of the coating surface. Gloss ranges from flat, eggshell, satin (semi-gloss), and gloss.
Glossy – Mirror-like finish of a coating.
Hand Tool Cleaning – The least clean of the Structural Steel Painting Council's specifications for surface preparation of steel.
Hazing – See oxidizing.
Hiding – The ability of a coating to obscure the surface to which it is applied.
High Build – A coating which cures to form a thick film in a single application.
Holiday – A missed or skipped area in the paint film.
Hydrolysis – Curing method of certain inorganic zinc-rich coatings where the silicate resin reacts with moisture in the air to form the cured film.

Inhibitors – Compounds added in small concentrations to form protective films or which combine with corrosion products to form less active compounds.
Inorganic – Compound not based on the element carbon.
Inorganic Zinc – Coating containing a zinc powder pigment in an inorganic vehicle; e.g. zinc silicate.
Iron Oxide – Rust.
Intumescent – A coating formulated to bubble and swell on heating to form an insulating cover over the substrate.
Ketones – A class of organic solvents such as acetone, MEK, etc.
Lacquer – Type of coating that dries by evaporation of solvent.
Latex – Milk-like fluid made up of particles of rubber or synthetic resin suspended in water.
Leveling – The ability of a film to flow upon application to a smooth finish, minimizing streaking and applicator marks.
Lifting – Solvent attack on previously applied film, causing distortion, wrinkles or blisters.
Linseed Oil – Most common oil used in coatings. Features easy brushing, fair drying, and poor alkali resistance.
Matte – A coating surface with low gloss and little sheen. See flat.
Mil – One thousandth (1/1000) of an inch.
Mill Scale – Layer of iron oxide formed on the surface of steel plates and sheet during manufacture. May be 2-5 mils thickness.
Modified – A mixture of resins, one of which is predominant.
Monomer – Molecule of low molecular weight capable of conversion into polymers, plastics, and synthetic resins.
Mottled – Coating with spotted appearance, blotches of different colors or shades.
Mud Cracking – Cracking that occurs in heavy paint films as they dry, appearing like dried mud.
Oil Oxidation – Cure method where resin molecules of the same type polymerize in the presence of oxygen to form a cured film.
Oleoresinous – Pertaining to the vegetable oil binder found in oil/alkyd paints.
Opaque – Unable to be seen through.
Organic – Based on the element carbon.
Organic Zinc – Coating containing zinc powder pigment and an organic resin; e.g. zinc and epoxy.
Osmotic Blistering – Blistering of film due to salt deposits beneath the coating. Wet blisters, filled with salt solution, are formed.
Overcoat – Mid layer or topcoat.
Overspray – Sprayed coating that is dry when it hits the surface, resulting in dusty, granular adhering particles.
Oxidized Film – Coating that has lost its gloss, or whose surface has become powdery.
Paint – Any pigmented, liquid material that, when spread in a thin layer, solidifies into a film that obscures the surface on which it is applied.
Peeling – See delamination.
Permeability – The ability of water vapor to diffuse through a membrane.
Phenolic – Synthetic thermosetting resin. These resins can be formulated to produce coatings, varnishes, molding materials and adhesives.
Pickling – Immersion in an acid bath to remove rust, mill scale and other surface contaminants.
Pigment – Insoluble finely divided material whose function is to provide obscuring value, color and protection.
Pinholing – Formation of tiny, circular holes up to a few millimeters in diameter in the film.
Pitting – Result of local corrosive attack forming holes in a metal surface.
Plasticizer – Material added to improve flexibility and assist in compounding a coating.
Plastisol – Dispersion of vinyl resin particles in liquid plasticizer. Liquid film is converted to solid by heat fusion.
Polyamide Resin – Chemically reacts with epoxy resins and contributes excellent water resistance, toughness, and adhesion. Less toxic, more water resistant, and more flexible than an epoxy polyamine.
Polyamine Resin – Chemically reacts with epoxy resins and contributes excellent chemical resistance and film hardness.
Polymer – Substance composed of giant molecules formed by the union of a group of simple molecules or monomers.
Polymerization – Uniting of monomers to form a polymer.
Polyurethane Resins – Class of resins obtained by the reaction of diisocyanate with organic compounds to form polymers.
Polyvinyl Chloride – A synthetic thermoplastic polymer prepared from vinylchloride.
Porosity – The ratio, usually expressed as a percentage, of the volume of voids in a material to the total volume of the material, including the voids.
Pot Life – The length of time that an open container of one-part or an already mixed two-part coating remains suitable for application. See also shelf life.
Power Tool Cleaning – The highest degree of non-blast cleaning in the SSPC specifications. The cleaning is done by hand held power tools such as grinders, sanders, etc.
Primer – First coat applied to a surface, usually for specific effects, such as better adhesion, surface wetting, or inhibiting corrosion.
Recoat – To add another layer of coating to an existing layer.
Red Lead – A toxic, orange colored, oxide of lead (Pb_3O_4) used as a rust inhibitive primer.
Reducer – See thinner.
Reflective Coating – A coating that is formulated to absorb the ultraviolet band of solar radiation and reflect it back as visible light.
Resin – Any of a group of amorphous organic natural or synthetic materials; usually can be molded or dissolved.
Resin – See binder.
Retarder – Liquid added to a coating to delay the drying rate.
Runs – Heavy "V" shaped or pencil shaped vertical build-ups on surface of coating due to excessively thick applications of coating or overthinning.
Rust – Formation of visible iron oxides due to corrosion of iron or steel.
Rutile – A mineral, consisting of titanium dioxide usually with a little iron, of a reddish brown color.


Rust


Oxidized Film


Mottled Paint

Sag – Heavy "U" shaped build ups or horizontal lips on the surface of coatings due to excessively thick applications of coating or overthinning. A long sag is called a curtain.

Saponification – Reaction of an oil or alkyd coating to an alkaline substrate resulting in poor adhesion.

Satin – A coating whose surface is slightly shiny; term is used interchangeably with semi-gloss.

Sealer – An undercoat used as a barrier between substrate and topcoat to provide a uniform, chemically inert surface and to prevent bleed.

Semi-Gloss – A coating finish that is more glossy than an eggshell but less shiny than a glossy finish. Also called satin.

Shelf Life – The length of time that an unopened or unmixed coating may be stored and still be suitable for application. See also pot life.

Shellac – A resin or gum dissolved in a spirit varnish, used as sealer for porous surfaces under more durable top coats.

Silica – A class of extender pigments that include talc, china clay and mica that are used to control sheen and settling properties.

Silicone – Resin formulated into coatings to withstand high temperatures.

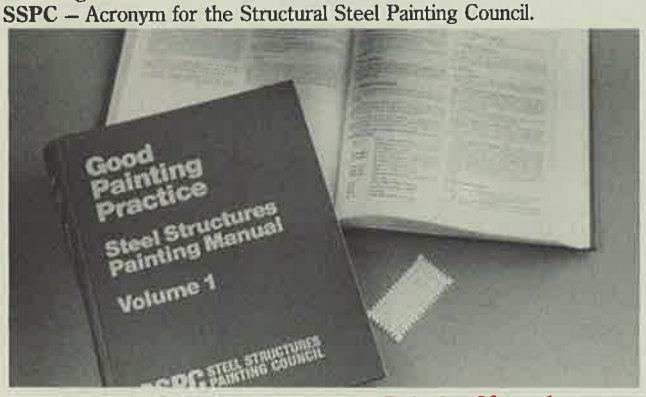
Solids By Volume Ratio – Ratio of non-volatile material in a gallon of coating to the overall coating volume, expressed as a percentage; also called volume solids.

Solvent – Component of coating that gives the coating its liquid form and allows it to be applied.

Solvent-Base – A coating with binders that contain or will dissolve in organic solvents.

Spread Rate – The theoretical area that will be covered by a gallon of coating at the manufacturer's recommended wet film thickness.

SSPC – Acronym for the Structural Steel Painting Council.



SSPC's two volume Steel Structures Painting Manual

Stabilizer – A substance added to a coating to extend the shelf life of water-base paints.

Stain – Semi-transparent or semi-opaque coating with a limited amount of pigmentation.

Stripper – A solvent chemically formulated to remove most types of cured paint from a substrate.

Styrene Butadiene – The binder used in what is commonly referred to as "latex" paint.

Substrate – The surface to which the initial coating layer is applied.

Surfactant – Any substance which has the capability of migrating preferentially to surfaces and is capable of altering the properties of the surfaces.

Surfacer – An undercoat used to provide a smooth, uniform surface for coating.

Synthetic – Manufactured, as opposed to occurring naturally.

Thermoplastic – Having the property of becoming soft upon the application of heat. Regains hardness upon cooling.

Thermosetting – Having the property of becoming insoluble with the application of heat.

Thinner – A solvent added to a coating to adjust viscosity.

Tie Coat – A coating used over non-ferrous substrates to promote adhesion.

Titanium Dioxide – A pigment used for white paints which provides good hiding characteristics. Type I is 94% purity and is not chalk resistant. Type III is 80% purity and has medium to high chalk resistance.

Tooth – The roughness of a coating surface.

Top Coat – Finish coat.

Undercoat – A coating used as the initial or mid layer application. Undercoats (also called underfilms) include primers, sealers, block fillers, and other coatings that are meant to be covered by a finish coat of a similar or dissimilar coating.

Varnish – A binder for enamels. The resins are chemically combined with the oil at high temperature to give a product increased hardness and much faster drying time. Also, a clear finish for wood, primarily furniture and interior woodwork.

Vehicle – Liquid portion of coating; solution made up of solvent and binder.

Velvet – A paint finish that is glossier than matte, but not as glossy as satin. Also called eggshell.

Vinyl Toluene – A resin used in wood sealers and stain killers used primarily where a fast dry is required.

Vinyl Wash Primer – A primer which contains phosphoric acid which reacts with the zinc surface to form a tight bond on galvanized steel.

Viscosity – Resistance to flow. The higher the viscosity, the thicker the coating and the less able it is to flow.

Volatile – Solvent component of the vehicle. The portion that evaporates.

Volume Solids Ratio – See solids by volume ratio.

Water-Base – A coating of a composition which dissolves in or is dispersed in water.

Wet Film Thickness – The thickness of an application before curing.

Wetting Agent – An additive used as a manufacturing aid in grinding pigments.

White Metal Blast Cleaning – The cleanest of all SSPC specifications.

Wrinkling – The formation of a wrinkled surface in the top coat of paint due to an excessively thick application of coating, or slow drying conditions.

Zinc – Metallic element used as a sacrificial metal to protect steel from corrosion.

Zinc Dust-Zinc Oxide – A pigment used to inhibit steel corrosion and add adhesion, elasticity, and abrasion resistance which usually contains about 80% zinc dust.

Zinc Rich Primer – A primer which contains a high proportion of zinc dust pigment, up to 95% by weight.

We wish to acknowledge the following companies for their assistance in the preparation of this glossary:

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PPG Industries, Inc.	(Pittsburgh Paints)
Devoe & Raynolds Company	(Devoe Paints)

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technical notes

Comparing Costs

Since a paint or coating film is made up of the solids that remain after the solvent evaporates, the one that would cover the most area would be made up entirely of solids. However, except for some special-case high technology coatings, none are. The amount of solids in a gallon of paint to the overall volume of the coating is called the volume solids ratio. This ratio is an important factor in determining the actual cost of a coating.

A coating that is 100% solids would, in theory, cover an area of 1,604 square feet at one mil thickness. To determine the theoretical coverage per mil thickness for any gallon of paint, multiply the volume solids ratio times 1,604 square feet. To determine how far a gallon of paint or other coating will go, divide the coverage by the dry film thickness required by the manufacturer. By dividing the area of the project by this result, and rounding fractional results upward, the number of gallons of paint required can be determined.

To compare the actual cost for different brands of the similar formulation paints, simply multiply the cost per gallon times the number of gallons of coating required to complete the project. A higher cost coating with a higher volume solids ratio may, in fact, be less costly than a coating with a lower per gallon cost and a lower volume solids ratio. (see example)

A high volume solids coating can also be less expensive in application labor as a thicker dry film will be applied all at once, possibly eliminating the need for recoats.

Example:
Assume project is 2005 sq. ft.

Paint A: **50%** solids
50% volatiles
Recommended film thickness 2 mil
Cost per gallon $15.00

Theoretical Coverage	=	50% x 1604 sq. ft.
	=	802 sq. ft./mil
Coverage per gallon	=	802 sq. ft./2 mils
	=	401 sq. ft.
Gallons required	=	2005/401
	=	5 gallons

Cost to complete project
5 gallons x $15.00 = **$75.00**

Paint B: **40%** solids
60% volatiles
Recommended film thickness 2 mil
Cost per gallon $12.00

Theoretical Coverage	=	40% x 1604 sq. ft.
	=	642 sq. ft./mil
Coverage per gallon	=	642 sq. ft./2 mils
	=	321 sq. ft.
Gallons required	=	2005/321 = 6.3
	=	7 gallons

Cost to complete project
7 x $12.00 = **$84.00**

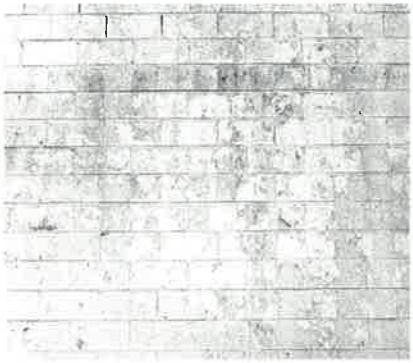


photo at left shows the delamination that can occur between incompatible coatings on a block wall

Block Fillers

Concrete block is an extremely porous material that tends to allow moisture penetration, especially in conditions of driving rain. The large pores can cause holes in the paint film. Fillers are specialized coatings formulated to fill the pores and minimize water absorption into or through the block.

For most exterior applications, an acrylic resin block filler is recommended. Vinyl resin block fillers are also available, but should be confined to interior use. If water should penetrate the wall through hairline cracks in the mortar joints, the alkalinity that results can saponify a vinyl resin filler, causing progressive failure in the coating. Acrylic resins are not affected by alkalinity.

If an enamel or high build coating is used on the interior side of an exterior wall, a modified epoxy cementitious filler is recommended. This special filler is formulated to prevent failure due to moisture penetration and possible pressure build-up behind these highly-sealed coatings.

No matter which block filler is used, the most important key to a successful project is that all the voids are filled, and no pinholes or holidays exist. Complete filling of all the pores and using the correct formulation block filler will help minimize chances of film failure due to moisture penetration.

(continued from page 3)

MILL SCALE FAILURE

Appearance

- Unbroken blistering on film surface.

Cause

- Formation of rust under mill scale.

Remedy

- Grind clean, use primer designed for use on mill scale bearing steel, and repaint.

Prevention

- Prepare steel surface by pickling or blasting before priming.

MOLD AND MILDEW

Appearance

- Black growths on surface. Stains will lighten or disappear if a few drops of bleach are applied. If the stain does not bleach out, it is probably soot, dirt or pollutants.

Cause

- High humidity and warm temperatures.
- Areas where moisture remains over prolonged periods.

Remedy

- Scrape and wash with solution of ⅔ cup trisodium phosphate, ⅓ cup laundry detergent, 1 quart household bleach and 3 quarts warm water, wearing rubber gloves and goggles when mixing and applying.
- Rinse thoroughly.
- Prime with mildewcide primer before repainting, repaint.

Prevention

- Be sure that paint application does not contain thin spots.
- Use a mildew-resistant primer and/or finish in areas likely to remain damp or in areas of high humidity.

ORANGE PEEL

Appearance

- Fine pebbled surface texture on spray applied coating.

Cause

- Insufficient atomization.

Remedy

- Adjust material, equipment and technique to allow better flow and leveling.
- Sand surface smooth and recoat.

Prevention

- Use thinners, spray equipment and application techniques suitable to the material applied.

OVERSPRAY (SEE SANDY APPEARANCE)

mildew on a painted concrete wall

PINHOLES

Appearance

- Small round holes in film.

Cause

- Solvent migration through the film after it has begun to set.
- Moisture in spray lines.
- Hot substrates.
- Insufficient atomization of viscous materials.
- Can also be caused by excessive atomization.

Remedy

- If small areas, touch up.
- If a general condition, sand smooth and repaint, or, apply a thin mist coat to fill surface voids, and recoat when conditions are more suitable.

Prevention

- Use slower evaporating solvent.
- Thin excessively viscous materials.
- Minimize atomization pressure.

pinholing

ROLLER MARKS

Appearance

- V-shaped texture pattern on roller applied surfaces.
- Lines at edges of roller passes.

Cause

- Use of long nap roller on smooth surface.
- Material not properly thinned.
- Material not rolled out properly.

Remedy

- Change roller cover to shorter nap.
- Make solvent adjustment to improve flow and leveling.

Prevention

- Use roller cover with nap length suitable for surface to be covered.
- Thin in accordance with manufacturer's recommendations.
- Use proper application techniques.

mill scale failure. blisters have broken showing rusting underneath

RUNS, SAGS AND CURTAINS

Appearance

- Heavy build-ups of coating. Runs are "V" or cylindrical shaped, sags are "U" shaped or horizontal lips on the surface of coatings. Curtains are long sags.

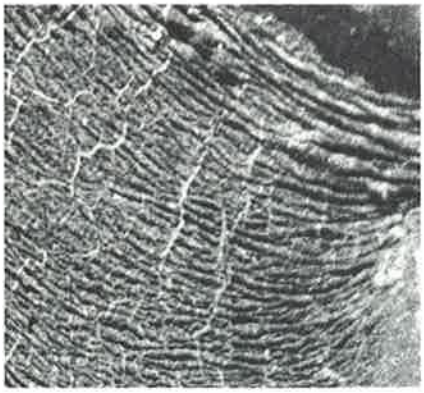
run

(continued)

Cause
- Excessive film build.
- Overthinning.

Remedy
- Sand smooth and recoat with properly thinned material.

Prevention
- Thin in accordance with manufacturer's recommendations.



sag

SANDY APPEARANCE, OVERSPRAY, DRY SPRAY

Appearance
- Rough, sandy appearance on spray applied coatings.
- Rough, dull appearance of any coating.

Cause
- Partially dried spray particles being deposited on surface.
- Dust or dirt contamination of wet coating.

Remedy
- For overspray, spray solvent over it so that it "melts in."
- Sand contaminated areas smooth and recoat.

Prevention
- Use proper spray techniques to avoid overspray.
- Do not spray when windy.
- Protect freshly coated surface from dust contamination by isolating it, or do not coat until conditions are favorable.

SAPONIFICATION

Appearance
- Loss of gloss, discoloration, delamination, cracking, sticking, gumminess, or appearance of brown streaks.

Cause
- Non-alkali resistant coatings, such as oil or alkyd paints or varnishes, coming into contact with alkaline materials such as new cement, mortar, plaster.
- Airborne caustic contamination forms soap at the interface resulting in poor adhesion.

Remedy
- Clean and repaint with an alkali-resistant coating.

Prevention
- Zinc coatings should have a barrier coat such as acrylic emulsion paint or epoxy enamel before application of alkyd or oil paint.
- Allow new masonry surfaces to age 60 to 90 days before painting so no active alkali is present.
- Do not allow water to penetrate masonry walls since new alkali can form, causing the coating to saponify in place.
- Provide alkali-resistant barrier coat.

SHADOWING

Appearance
- Uneven color or shadowy appearance of topcoat.

Cause
- Insufficient number of coats.
- Low film build.
- Insufficient mixing.

Remedy
- Recoat deficient work.
- Apply heavier wet film.

Prevention
- Use coating with a higher film build.
- Mix in accordance with manufacturer's recommendations.
- Apply an additional coat to new work.

SOLVENT TRAP

Appearance
- Coating does not completely cure.

Cause
- Too thick of an application of coating.
- Low curing temperature.

Remedy
- Force-dry.
- Remove and recoat if coating does not cure.

Prevention
- Follow manufacturer's recommendations for application temperatures and thicknesses.

WATER SPOTTING

Appearance
- Pockmarking in the shape of large raindrops.

Cause
- Water or rain dropping on incompletely cured film.

Remedy
- Sand lightly and recoat.

Prevention
- Use quick dry thermoset coatings such as epoxies in climatic conditions that have frequent showers.
- Cover area above material to be coated.
- Paint early in the day before afternoon showers.

WRINKLING

Appearance
- Wrinkled deformations in the topcoat.

Cause
- Top film dries before underlying coat has cured.
- Applying paint too thickly.
- Inadequate brushing out.
- Applying a coating at higher temperatures than recommended by manufacturer.
- Insufficient recoat time.

Remedy
- Sand smooth or scrape off wrinkled layer.
- Recoat with proper thickness of film.

Prevention
- Apply proper film thickness.
- Wait until underfilm is dry enough to recoat without exceeding maximum recoat time.
- Do not paint with a latex-type paint when the temperature is less than 50 degrees, or other coatings when below 40.
- Do not paint in direct sunlight.

staff notes

Consultants 1985

Hoffmann Architects would like to acknowledge those architects, engineers and other consultants who provided services that helped us serve our clients better throughout the country in 1985.

Applied Technical Services, Inc., Marietta, GA	TL
D. Lee Dunlap Associates, Inc., Dallas, TX	AR
DeMars & Hofmann, Architects, Atlanta, GA	AR
Gunther Engineering, Inc., Boston, MA	CE,LS
Hammel Green & Abramson, Inc., Minneapolis, MN	AR,CE,EE,ME,SE
Harry C. Hoover, Jr. and Associates, Inc., Dallas, TX	AR
Hill & Harrigan, Inc., North Haven, CT	EE,ME
Infratek, Inc., Atlanta, GA	IT
Kaselaan & D'Angelo Associates, Inc., Haddonfield, NJ	EN
Nannis & Associates, Inc., Atlanta, GA	SE
New Haven Testing Laboratory, Inc., New Haven, CT	TL
Theodore A. Nelson, PE, Madison, CT	SE
Perry & Mauldin, Inc., Atlanta, GA	ME
Polytron, Inc., Norcross, GA	EE
Proscan, Norwood, MA	IT
Rotz Engineers, Indianapolis, IN	EE,ME
Shimel and Sor Testing Laboratories, Inc., Cedar Grove, NJ	TL
Siegel & Rutherford Consulting Engineers, Baltimore, MD	EE,ME
Spiegel & Zamecik, Inc., Washington, DC New Haven, CT	SE
Testwell Craig Laboratories, Danbury, CT	TL
TECON, Inc., Fort Lauderdale, FL	AR
Woolen, Molzan & Partners, Indianapolis, IN	AR

KEY

Architects	AR	*Infrared Thermography*	IT
Civil Engineers	CE	*Land Surveyors*	LS
Electrical Engineers	EE	*Mechanical Engineers*	ME
Environmental Consultants	EN	*Structural Engineers*	SE
		Testing Laboratory	TL

Staff News

John J. Hoffmann, AIA reviewed the new pages on the building envelope for the 8th edition of Architectural Graphic Standards, the main reference book for architects, a publication of the American Institute of Architects. He was recently accepted as a new member of the Architects, Engineers and Building Officials section of the National Fire Protection Association. In addition, John has begun his fourth term as treasurer of the Southeast Connecticut Chapter of the Building Owners and Managers Association (BOMA.)

Walter E. Damuck, AIA was a panelist at an American Arbitration Association seminar, and acted as mediator in a sample arbitration case.

Harwood W. Loomis, AIA represented the architecture profession on the 16-member Governor's Task Force on Safety in Public Buildings. The purpose of the Task Force was to recommend improvements in fire code enforcement.

Amy C. Kilburn, AIA attended a 4-day seminar on how to interpret and apply the 1985 Life Safety Code. The seminar was sponsored by the National Fire Protection Association.

Josephine Bernardo, speaking on the topic of customized computer software, was an instructor at a financial management seminar sponsored by the Society of Architectural Administrators.

Karen L. Warseck attended a seminar on protective coatings which included fundamentals of coating technology, principles of corrosion, coatings selection, surface preparation, and inspection techniques and equipment.