

DEFECTS IN PAINT COATINGS

*by CM Staff
based on information supplied by Wattyl Paints*

INTRODUCTION

Recognising the type of paint failure encountered in the field is an important mechanism in ensuring quality coatings and coating application. Identification of causes of problems can be fed back into the specification and application process to avoid repetition of failure events.

Causes of paint coating failure are frequently associated with either:

- incorrect specification
- faulty material
- incorrect application
- incorrect curing/post handling procedures.

All paints eventually fail by weathering and the life expectancy of a paint system will be well defined by the manufacturer or within performance standards such as AS/NZS 2312 - *Guide to the Protection of Iron and Steel from Atmospheric Corrosion*.

Those that fail prematurely will have done so because of an identifiable problem associated with their application.

A great deal of research has gone into paint technology development by the major Australian and international paint companies as they compete with each other and with other coatings and materials to produce better performing products.

Environmental pressures on paint manufacturers to eliminate potentially hazardous pigments and reduce the amount of volatile organic greenhouse-causing solvents in paint coatings has accelerated the development of new types of paint coatings.

Water based, low solvent or solventless coatings have replaced many of the standard industrial coatings of yesteryear. Hybrid organic/inorganic binder systems have also been developed that, while expensive, offer advances in durability over traditional technologies.

Again, AS/NZS 2312 provides one of the most valuable reference works for paint coatings and paint

systems, with detailed descriptions of a wide range of generic paint types, their suggested uses and characteristics.

In some cases, paint failures can be traced to the incorrect selection of paint for the particular application. One of the most common examples of incorrect paint selection is the use of alkyd (oil based) paints, for painting galvanized coatings.

The paint reacts with the zinc in the galvanized coating and loses its adhesion, resulting in the common phenomenon of flaking or peeling paint.

Many paints have poor UV resistance, and again, oil based paints, unless they are specially formulated will rarely give the same durability as water-based acrylic paints, which have excellent UV stability over time, or two-pack urethane or acrylic systems.

Water based acrylic paints have very good compatibility with galvanized coatings and rarely have adhesion problems on properly prepared surfaces.

Industrial or marine applications are critical applications where the performance requirements of the paint system must be clearly understood.

Epoxy coatings are often considered the cure-all for most industrial applications, but may perform poorly in highly acidic exposures or where movement or vibration may result in cracking of the relatively inflexible paint film.

It is therefore important for specifiers to clearly identify the environment in which the coating has to operate and ensure that paint systems selected are capable of delivering the life cycle performance expected.

There is always a reason for every coating failure, and frequently, coating defects do not always affect the coating's performance, but only its appearance.

The following catalogue of paint defects has been assembled with associated descriptions of causes and remedies to assist in identifying problems and dealing with them to ensure a quality coating.

DESCRIPTION	CAUSE	REMEDY
SAGS - also called runs or curtains. Excess flow of paint	Spray gun too close to work; too much thinner; too much paint; or surface too hard or glossy to hold paint.	Before cure, brush out excess paint and modify spray conditions. After cure, sand and apply another coat.
ORANGE PEEL - hills, valleys in paint resembling skin of orange	Paint too viscous; gun too close to surface; solvent evaporated too fast; or air pressure too low for proper atomization.	Before cure, brush out excess paint and modify spray conditions. After cure, sand and apply another coat.
OVERSPRAY - also called dry spray. Dry, flat, pebbly surface	Particles reaching surface not wet enough to level because of too rapid solvent evaporation; gun too far from surface; or paint particles falling outside spray pattern.	Before cure, remove by dry brushing followed by solvent wiping. After cure, sand and apply another coat.
COBWEBBING - thin, stringy paint, spider web-like particles	Solvent evaporating too rapidly. Most common with fast evaporating lacquers, such as vinyls and chlorinated rubbers.	Use slower evaporating solvent or apply when cooler. After cured, sand and apply another coat.
CRATERING - also called pitting. Small, uniform indentations in film	Air pockets trapped in wet film during spraying.	Sand or blast to smooth finish and apply additional coats.
FISH EYES - separation or pulling apart of wet film to expose underlying finish or substrate	Application over oil, dirt, silicon, or incompatible coating.	Sand or blast remove; brush apply a fresh coat plus topcoat.
BLUSHING - flat finish with milky appearance	Moisture condensation in high humidity with fast evaporating or unbalanced thinner in spray application.	Sand or blast remove; respray with retarder added to thinner.
UNEVEN GLOSS - non uniform sheen, shiny spots	Non uniform film thickness; moisture in film. Temperature change during curing; or paint applied over soft or wet undercoat.	Allow to dry and apply another finish coat under acceptable conditions for moisture and humidity.
FADING - colour changes or irregularities	Ultraviolet light degradation; or moisture behind paint film.	Repaint and avoid possible sources of moisture.
WRINKLING - rough, crinkled surface	Surface skinning over uncured paint because of too much thickness and/ or too warm weather, especially with oil-based paints.	Scrape off wrinkles and apply thinner coat; avoid intense sunlight.
BLISTERING - small to large broken or unbroken bubbles	Solvent entrapment; oil, moisture or salt-contaminated surfaces; or cathodic disbonding.	Blowers in enclosed areas to accelerate solvent release; adequate cleaning of surface contamination; proper levels of cathodic protection.
PINHOLING - tiny, deep holes exposing substrate	Insufficient paint spray atomization; coarse atomization; or settled pigment.	If uncured, brush out and apply additional coat. If cured, apply additional coat.
PINPOINT RUSTING - rusting at pinholes or holidays	Pinholing or too high a steel surface profile for coating thickness.	Use holiday detector for early detection of pinholes; apply additional coats after mechanical or blast cleaning.

DESCRIPTION	CAUSE	REMEDY
CHECKING - narrow breaks, usually short, in topcoat that expose undercoat	Limited paint flexibility; too thick a coat; or applied at too high a temperature.	Sand or mechanically remove checked coat and apply another coat.
CRACKING - deep cracks in paint that expose substrate	Paint shrinkage; limited flexibility; excessive thickness (especially zinc-rich paints); or applied/cured at too high a temperature.	Sand, blast, or mechanically remove total paint and apply new coat.
UNDERCUTTING - blistering and/or peeling of paint where exposed steel is rusting	Corrosion products formed where steel is exposed, undermining and lifting paint.	Early detection of defects with holiday detector and correction; use inhibitive pigments in primer.
DIRT UNDER PAINT - peeling; dirt dried in paint film	Contaminated surface, spray, or work area.	Sand, blast, or mechanically remove paint and re-coat.
DELAMINATION - peeling from undercoat or substrate	Separation/lifting of paint from chalky substrate or smooth, poorly bonded undercoat.	Sand or mechanically remove all loose paint, clean and roughen smooth surface, and re-coat.
PIGMENT OVERLOAD - also called pigment float, mottled surface	Critical pigment level exceeded (sometimes by tinting white paint rather than tint base).	Apply properly prepared finish coat.
IRREGULAR SURFACE DETERIORATION - deterioration at edges, corners, crevices, channels, etc.	Difficult to coat surfaces; or configurations that permit collection of moisture, salt, and dirt.	Round edges; fillet weld seams and crevices; avoid configurations that permit collection of contaminants; provide drainage.
ABRASION DAMAGE - mechanical damage	Physical damage by abrasion (also impact).	Provide fendering protection; spot repair and use more abrasion or impact-resistant coatings.
FOULING DAMAGE - penetration or peeling by action of marine fouling organisms	Barnacles, etc, penetrating soft coatings (eg. coal tar); weight of fouling peeling poorly bonded paint.	Remove and replace damaged paint with one tougher or more adherent; use anti-fouling paints for fouling control.
MUD CRACKING - deep, irregular cracks as with dried mud	A relatively inflexible coating applied too thickly (especially common with inorganic zincs).	Remove coating and abrasively blast steel before reapplying lesser thickness; sanding/mechanical cleaning may be acceptable on older substrates.
PEELING OF MULTIPLE COATS - peeling of heavy paint build-up from substrate	Stress from weathering (contraction of total system) exceeds adhesion to substrate.	If limited, spot-remove loose paint and apply flexible paint (e.g. latex); if extensive, scrape, sandblast, mechanically or chemically remove paint to substrate before re-coating.
PEELING OF THICK, INFLEXIBLE PAINT - peeling of thick paint from substrate	Stress from cured, weathered (contracted) paint exceeds adhesion to substrate.	Same as above
PAINT APPLIED TO DAMP SURFACE - heavy wrinkling	Moisture on substrate distorts wet film.	Remove by scraping or sanding and re-coat under dry conditions.
MOISTURE DAMAGE - peeling of paint by underlying moisture	No means by which interior moisture can be vented to exterior.	Use wedges between adjacent lap boards, vents, etc, for migration; clean painted vent holes.

DESCRIPTION	CAUSE	REMEDY
EFFLORESCENCE DAMAGE - paint disbonding and peeling by loose, powdery material	Moisture through concrete, masonry, or brick picks up soluble salts and deposits them on the surface from the interior (can be on interior or exterior well of building).	Treat as in NCEL Tech Data Sheet 77-10 or NAVFACMO-110, 4.4.3.5 for concrete/masonry before painting; seal more humid side of wells.
VINE PENETRATION OF PAINT - vine tendrils penetrate paint	Vines so close to structure that tendrils penetrate paint for support.	Relocate vines away from structure; sand and re-coat damaged areas.
MILDEW GROWTH - black fungal growth	Microorganisms grow, especially on damp, shaded paint, defacing and degrading it.	Clean and repaint as described in NAVFAC MO-110, 10.3.2.5 and 10.2.2.73
CHALKING EROSION - gradual thinning of finish coat to expose undercoat	Degradation of coating resin by sunlight leaving loose residue; especially bad with thin coats, epoxies, and substrates where chalk is frequently removed.	Remove loose chalk and apply chalk-resistant finish coat.
BLEEDING - brown staining of paint in asphalt or coat tar coating	Organic solvent in wet paint or fresh asphalt dissolves bituminous material and causes it to migrate through paint.	Use latex paint over bituminous materials; allow asphalt pavements to cure 21 days before applying paint.
SKINNING/DETERIORATION OF STORED PAINT	Improper storage of paint (e.g. in sun and rain), especially fast drying paints.	Store indoors in cool environment; avoid opening and resealing of large containers.

Description: Flaking paint over galvanized surface.

Cause: Incorrect surface preparation. Incorrect primer/topcoat.

Remedy: Remove flaking paint by scraping or wire brushing. High pressure water wash surface. Apply appropriate water based or epoxy priming systems.



Description: Flaking two-pack epoxy paint on crane rails in galvanizing plant pre-treatment building.

Cause: Low pH condensation (pH1) and flexing and vibration of crane rails in service cause brittle paint film to crack and promote underfilm corrosion.

Remedy: Wet abrasive blast back to remove surface contamination and old paint. Apply flexible, acid resistant recoatable mastic type coating



Description: Efflorescence bleeding through pinholes in paint film in marine exposure.

Cause: Pinholes in paint film caused by solvent entrapment or single coat application.

Remedy: Ensure paint is correctly applied and cured. Use multi-coat system to eliminate pinholes.



Description: Underfilm corrosion in defined regions of coating. This large tank has areas of clearly defined paint system performance.

Cause: Area on far left has severe local underfilm corrosion indicating initial poor surface preparation/priming. Centre zone is in good condition. Right hand zone shows general overall deterioration consistent with normal weathering but early failure indicative of low initial dry film thickness for the system.

Remedy: Apply as for centre zone.



Description: Early failure of maintenance topcoat system along beam edges.

Cause: Adhesion of old paint insufficient to accommodate surface tension effects of new two-pack system epoxy topcoat.

Remedy: Completely remove old paint prior to re-coating or use more flexible re-coating system compatible with old paint.



Description: Blistering of paint on handrail.

Cause: Areas of contamination on surface interfering with primer adhesion.

Remedy: Ensure surface cleanliness prior to application. On existing item, mechanically remove any blistered areas and feather back to sound paint. Re-apply primer and topcoat.

