

## U.S. General Services Administration Historic Preservation Technical Procedures

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06400-02

SUPPLEMENTAL GUIDELINES FOR REMOVING PAINT FROM INTERIOR AND EXTERIOR WOOD SURFACES

This standard identifies the causes of paint failure on wood surfaces and provides basic guidelines for deciding to what extent deteriorated paint layers should be removed. This procedure should be used in conjunction with 06400-07-R, "Chemically Removing Paint from Wood Features", and 06400-09-R, "Removing Paint from Wood Features Using Thermal Methods".

### \*\*\*GENERAL\*\*\*

- Exterior surfaces are painted both for aesthetics and for protection. Paint protects the wood substrate from ultraviolet degradation due to sunlight exposure and rotting due to excess moisture.
- Interior wood surfaces are usually painted for decorative reasons rather than for protection.
- Causes for premature paint failure:
  1. Excess moisture in wood causes the wood to swell, breaking the bond between the wood and the paint.
  2. Poor surface preparation interferes with the bond between the new paint layer(s) and the substrate.
  3. The wrong type of paint used in the wrong way and/or in the wrong place.

### \*\*\*TYPES OF PAINT FAILURE\*\*\*

#### PEELING/FLAKING:

- Paint may peel for a number of reasons:
  1. When applied over damp wood, (usually only a problem when water blasting has been used to remove loose paint)
  2. If painting was begun too soon after heavy rains.

NOTE: USE A MOISTURE METER TO DETERMINE THE AMOUNT OF MOISTURE IN THE WOOD. MAXIMUM MOISTURE CONTENT IS 14%.

3. When excessive moisture inside the wall migrates to the outside. The moisture may come from poorly vented bathrooms, kitchens, and laundries, or leaky gutters and flashing, or broken plumbing.
4. When applied to a dirty or greasy surface. The paint will not adhere and will cause intercoat peeling. The new paint film will simply peel off leaving the bottom paint layers intact. This is especially a problem:
  - under roof eaves and other protected areas not

readily washed by rain.

- when a slick surface is painted without first sanding it.
  - when an incompatible top coat is used.
  - when the top coat is applied more than two weeks after the surface was painted with an oil-based primer. A soap-like material forms on the surface of the primer which needs to be scrubbed off with detergent and water before the top coat is applied. If the surface is not scrubbed clean, the top coat will peel.
5. If the existing thickness of paint layers has reached or exceeded 16 mils and additional layers of paint have been added. Paint film thickness at 16 mils or more is said to have reached its saturation point. Additional layers of paint cause peeling for a number of reasons:
- The thick paint layers are less permeable to water vapor. Since the moisture cannot evaporate, pressure builds up behind the paint and peeling or blisters result.
  - The individual layers of paint can no longer expand and contract at the same rate and the older, more brittle layers fail resulting in peeling and cracking.
6. When exterior wooden elements have exposed end grain. Water absorbed in these areas causes the wood to swell, which loosens the bond between the wood and the paint.
- Susceptible areas include the ends of clapboard where they meet door and window trim or corner boards, butt and miter joints of clapboard and other trim pieces, and porch floor boards.
7. When water becomes trapped inside exterior hollow wooden elements such as columns or built-up fence newels, and adequate ventilation is not provided. Water vapor trapped inside can condense and settle at the base of the element, creating ideal conditions for rot.
8. When the surface has not been adequately washed. This is especially a problem if latex paint is applied over calcimine paint which is water soluble.
9. When protected areas are not readily washed by rain, causing dirt to accumulate on the surface. The dirt may have a tendency to attract and hold moisture against the building.
- The prolonged presence of moisture, combined with the lack of sunlight, can cause the top layer of paint to expand and contract more frequently than the lower layers, often resulting in a breaking of the bond between the paint layers and the wood substrate.
  - Protected areas to watch include eaves, soffits, tops of walls, or areas protected by trees and other vegetation.

10. If the species of wood used in construction is not suited dimensionally to provide the least amount of stress on the paint film, given the expansion and contraction rates associated with normal changes in relative humidity. For example, edge-grain, or quarter-sawn, softwoods are more dimensionally stable than flat sawn boards, warping and shrinking less. This places less stress on the paint film, thereby reducing the likelihood of cracking and peeling.

#### BLISTERS:

- Blisters may occur for several reasons:
  1. If the paint was applied in direct sunlight. The paint film forms a skin before the thinners of the paint have had a chance to evaporate and a blister forms. Usually a sound layer of paint is visible when the blister is split open.
  2. When paint has reached its saturation point as described above, or when paint has been applied to a wet surface. Usually bare wood is visible when the blister is split open.
  3. If a primer containing zinc oxide, or a finish coat containing zinc oxide without a proper prime coat is used. Zinc oxide is hydrophilic, meaning it has a strong affinity for water and will readily absorb moisture.

#### CRAZING AND CRACKING:

- Crazing and cracking usually occur:
  1. When old, thick layers of paint can no longer expand and contract at the same rate as the wood substrate. Initially, only the top layers are affected. However, as water gets into these fine, hairline cracks, they eventually deepen and widen to form major cracks.

#### ALLIGATORING:

- Alligatoring is an advanced stage of cracking where the deteriorated paint film takes on the appearance of alligator skin. It may occur:
  1. When a top coat is applied over a glossy paint surface that has not first been roughened to provide a proper "tooth" for the new paint film.

#### WRINKLING:

- Wrinkling is when the top layer of paint moves, or dries, while the paint underneath is also still drying, and also still moving, but at a different rate. This may occur:
  1. When the top coat is applied too thickly or not fully brushed out, allowing the top of the paint film to dry before the bottom of the film dries.
  2. When the second coat is applied before the first coat has had a chance to dry.
  3. If the paint is applied in hotter weather than the

manufacturer recommends. High temperatures cause the top of the paint film to dry too quickly, before the bottom of the film has had a chance to dry.

#### MILDEW:

- Mildew is likely to occur:

1. On damp paint films.
2. On crazed, cracked or peeling paint surfaces. Paint layers that are crazed and cracked are especially prone to mildew growth because moisture concentrates in the cracks.

Note: Painting over mildew without first killing it will not solve the problem. Mildew will just grow through the new paint. A sunny South or West facade is no guarantee that mildew will not grow.

#### \*\*\*DECIDING WHEN AND HOW MUCH PAINT TO REMOVE\*\*\*

GENERAL: It is important when making the decision to remove paint to determine why the paint is to be removed, because to do so is a time consuming and expensive job. (If the decision is made to remove all of the paint, samples of the existing paint layers should be taken to document and identify the paint colors used throughout the history of the building. A section of the existing paint film, located in an inconspicuous area, should be left alone and covered to allow for future study.)

- Paint should be removed when it has built up to the point of obscuring decorative details.
- Selective paint removal is also often done to expose a previous decorative finish such as graining or stenciling, or to restore a varnished or shellacked finish.
- The appropriate finish should be consistent with the original finish treatment. To expose the "natural beauty" of the wood, if the wood has always been painted is to impose modern tastes in interior decoration and should be avoided.

#### PEELING/FLAKING:

- For wholesale peeling and/or paint which has reached its saturation point:
  1. Remove all of the paint before repainting.
- For localized paint failure:
  1. Remove only the affected layers of paint.
  2. Sand the edges of the sound paint to provide a smooth transition between the old and the new
  3. Spot prime the area and repaint as required and as described in procedure 06300-01-S, 06300-02-R and 09900-07-S.

#### BLISTERS:

- For solvent blisters, or those where sound layers of paint are still visible under the blister:

1. Remove only the failed layers of paint. It is usually not necessary to remove paint to the bare wood.
  2. Spot prime and repaint as required and as described in procedure 06300-01-S, 06300-02-R and 09900-07-S.
- For localized water blisters:
1. Treat as for solvent blisters above if the surrounding paint is sound.
- For localized water blisters in conjunction with massive peeling of thick layers of paint:
1. Remove all of the paint.
  2. Prime and repaint as required and as described in procedure 06300-01-S, 06300-02-R and 09900-07-S.

#### CRACKING AND CRAZING:

- For surface crazing:
1. Sand the paint film only as necessary to remove the crazed layers of paint.
  2. Repainting may or may not be necessary.
- For cracking that reveals bare wood or a dark varnished or shellacked surface:
1. Completely remove all paint.
  2. Prime and repaint as required and as described in procedure 06300-01-S, 06300-02-R and 09900-07-S.

#### WRINKLING:

- For wrinkles in paint surfaces:
1. Sand the surface to the next unwrinkled layer.
  2. Repaint as required and as described in procedure 06300-01-S, 06300-02-R and 09900-07-S.

#### ALLIGATORED:

- For paint that has alligatored to form deep cracks:
1. Completely remove all of the paint.
  2. Prime and repaint as required and as described in procedure 06300-01-S, 06300-02-R and 09900-07-S.

#### MILDEW:

- For mildew growth:
1. Wash with a solution of bleach to kill the mildew. If the surface is also dirty, adding TSP to the bleach solution will aid in the cleaning process.
- For mildew associated with cracks in the paint film or other type of paint deterioration:

1. Treat the paint film as directed above for complete paint removal and repaint as required and as described in procedure 06300-01-S, 06300-02-R and 09900-07-S.

\*\*\*PAINT REMOVAL TECHNIQUES\*\*\*

- Paint removal is achieved through a variety of means:
  1. Thermal methods, such as heat plates and heat guns; See procedure 06400-09-R, "Removing Paint from Wood Features Using Thermal Methods" for guidance.
  2. Abrasive methods, such as by hand or with an orbital sander; See procedure 06300-02-R, "Procedures for Painting Wood Features" for guidance.
  3. Chemical methods; See procedure 06400-07-R, "Chemically Removing Paint from Wood Features" for guidance.
- Applications of the above methods should be reviewed in accordance with the Secretary of the Interior's "Standards for Rehabilitation Projects."

END OF SECTION

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