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SUBJECT

# HOUSE PAINT PRIMER STUDIES

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# HOUSE PAINT PRIMER STUDIES

## General Statement

Until 1935 no comprehensive house paint primer studies which covered the various fundamental features were undertaken. However, several brief exposure series were run prior to that date, the results of which are of definite interest, due to the extended exposure periods. The results after several years' exposure indicate that high White Lead content primers give excellent results, particularly on the resinous woods, which are regarded as difficult to paint satisfactorily.

These exposures further indicate that lower pigment volume concentrations than those advocated by the leading competitive pigment manufacturers can give very satisfactory results. Also, they clearly show the necessity of a considerable percentage of heat bodied oil in the formula, to control the penetration. Otherwise wide variations in the vehicle composition show only moderate differences in durability.

There are no indications to date that cheap primers will be effective and there are strong indications that house paint primers of satisfactory all around performance will have a cost approximately that of a first grade house paint.

The 1935 and 1936 exposure series cover the basic features as to house paint primer formulation in a systematic manner, paying especial attention to pigment volumes and inert pigment types. These exposures have not progressed sufficiently to permit of definite comments.

## 1932 Series

This series comprised 14 members, of which 12 were experimental and two representing competitive house paint primers (Patton and Devoe). The tests were made on both White and Yellow Pine one inch boards, 36" x 10" with the SWP White - Titanox B formulation as the finishing coat and exposed vertically in

March, 1932. White Lead in Oil was used as the basis of comparison.

There being a general agreement of thought that White Lead had shown the best performance on woods difficult to paint successfully, such as Yellow Pine and Fir, that a wood primer should contain White Lead as the predominating pigment. To secure the additional hiding power to permit of two coat work, a percentage of high hiding pigment was needed.

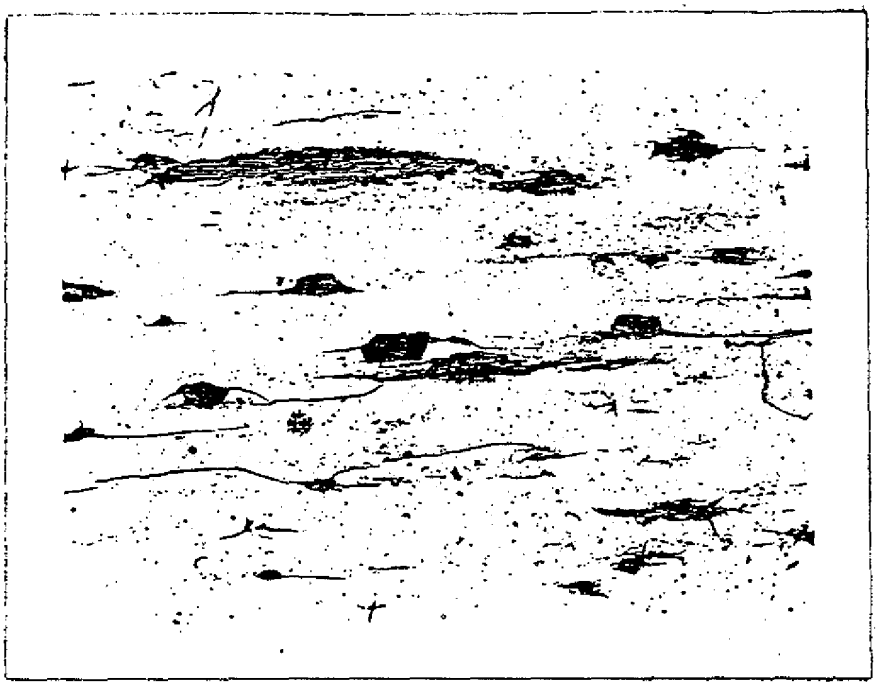
Zinc Sulphide was used in this series in preference to Titanium Oxide because of its better drying qualities, the combination being 90% White Lead (BLC) and 10% Zinc Sulphide. The vehicles were predominantly Perilla Oil with modifications of heat bodied oils and varnishes. The pigment volume concentration was 22% compared with White Lead in Oil reduced for priming according to standard directions of 23%.

Results

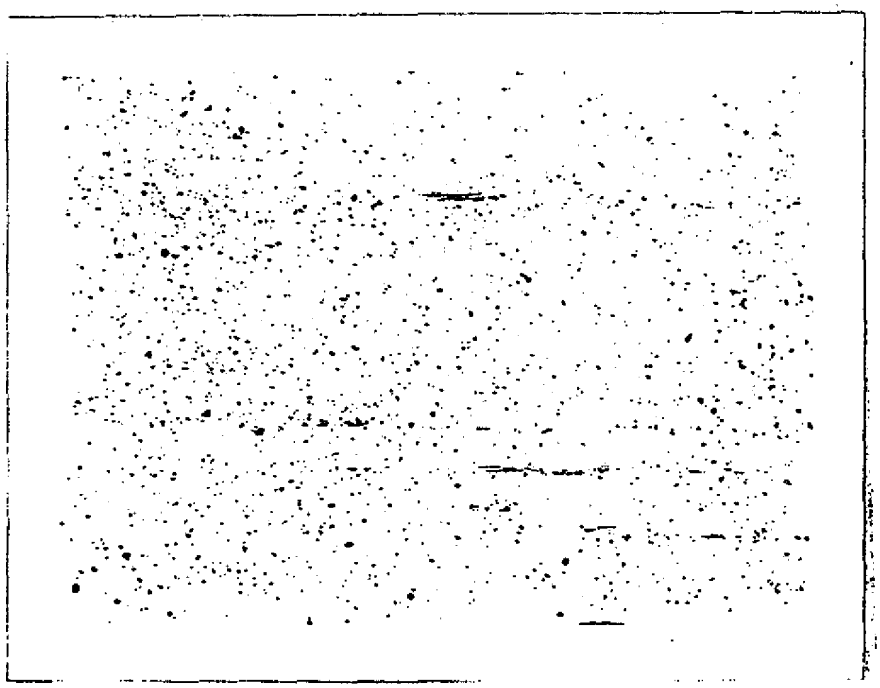
These exposures have gone through 4-1/2 years, including five complete summers. The White Pine panels are all in excellent condition with no appreciable differences or evidences of failure.

The Yellow Pine boards show marked differences, the degree of failure being less than with mixed paints self-primed. The White Lead in Oil reduced according to standard practice with Raw Linseed Oil exhibits many small areas all over the panel where the film had flaked off.

All of the 10 White Lead-Zinc Sulphide primers showed definitely less flaking and cracking than the White Lead panel. The consistent results clearly indicate that Zinc Sulphide does not react with the resinous materials in Yellow Pine causing cracking and flaking as commonly experienced with Zinc Oxide.



Magnification x 8 (Film #658)
White Lead in Oil, Yellow Pine, 5 summers' exposure.



Magnification x 8 (Film #660)
White Lead-Zinc Sulphide Primer #11, Yellow Pine, 5 summers' exposure.

Within the limits necessary to secure adequate hiding power, Zinc Sulphide maintains excellent adhesion on Yellow Pine and can be regarded as a suitable primer constituent.

The formulations containing maximum amounts of raw oil (90% or more of total oil content) exhibited distinctly greater tendencies to flake and approach the appearance of the White Lead in Oil panel.

Primers containing 30 - 35% of the non-volatile vehicle as bodied oils showed the least flaking tendency, the best general adhesion and all around performance.

Primers, the vehicle of which contained 15% Bakelite type varnish, showed greater tendencies to flake.

The following composition, Primer No. 11, gave slightly the best results:

| | |
|---|---|
| 900 pounds | White Lead (BLC) |
| 100 " | Zinc Sulphide |
| 44 gals. | Unbodied Oils - Perilla and Linseed |
| 10 " | Slightly Bodied - Linseed |
| 13 " | Medium Bodied Oils - China Wood and Perilla |
| 14 " | Volatile Thinners |
| 2-1/2 " | Drier |
| 100 gals. | (net) |

These exposures indicate that primers of low pigment volume - 22% - due to absence of inert pigments can, under certain conditions, maintain excellent adhesion and long life over both White and Yellow Pine, and show greater durability than Lead in Oil or mixed paints.

This exposure period of 4-1/2 years extends well into "the neglect period," for two coat work, the films showing considerable transparency due to wear, yet each affords a reasonably good surface for repainting.

The Devoe Lumilead primer showed flaking and cracking in excess of the Lead in Oil, presumably due to use of unbodied oils and Zinc Oxide.

The Patton primer produced long checks in the finishing coat, due to the plastic nature of this primer film.

1933 Series

This series comprised a comparison of the best member of the preceding series, Primer No. 11, as to brushing, drying and general performance with Patton's Wallhide Primer and Benjamin Moore's primer applied on Yellow Pine and under the SWP White - Titanox B formula.

The composition of the experimental #11 primer was modified slightly to represent pigment 90% White Lead - 10% Zinc Sulphide. The non-volatile vehicle-20% Linseed, 15% China Wood Oil and 65% Perilla. Of the total oil content 20% represents heat bodied oils of about 50 second viscosity and 15% of only slightly bodied oils.

Results

These exposures have extended through four summers. Aside from a few wood cracks generally characteristic of Yellow Pine lumber, each of the films remains in good condition, with no evidence of flaking.

1934 Series

The Lincoln Company, one of the smaller affiliated companies, decided in March, 1934 to adopt a house paint primer. The above #11 experimental primer was selected. It was decided again to run exposure tests of the #11 primer on both Yellow and White Pine under the Lincoln Outside White (Titanox B type) and against both the Lincoln Outside White self-primed, SWP White (Titanox B type) self-primed and a conventional Aluminum Primer.

Another primer, based on a pigment composition of 77% Lead Titanate and 23% inert (Sericite) with a similar vehicle, but with a pigment volume of 32% was included in this series. This primer was exposed under SWP White (Titanium Oxide type) and against the SWP White self-primed as the guide paint. Also against the above #11 primer. Both were applied under SWP White (Titanium Oxide type). Lead Titanate being regarded as the most inert of the Lead pigments would be expected to remain unaffected by the resin acids in the Yellow Pine.

Results

These exposures have now extended through three summers. On the White Pine, the Lincoln Outside White self-primed has failed badly, many long cracks with incipient flaking, extensive checking of the Outside White over the Aluminum Primer and slight checking of the Outside White over the #11 primer.

The condition of #11 primer and the Lead Titanate primer under the present SWP White on Yellow Pine is excellent.

The behavior of all the primers over Yellow Pine to date is excellent. The Lincoln Outside White self-primed is showing incipient flaking.

1935 Series

The 1935 series of House Paint Primer tests comprise 77 variations designed to cover in a systematic manner the fundamental features of primer formulation. Special attention was given to certain phases as described below.

A study was made of vehicle composition, to determine the proper balance between volatile and non-volatile proportions. Also to arrive at a satisfactory ratio of raw to processed oils, to permit adequate penetration and priming of the wood, while still retaining sufficient oil in the primer film to give

the proper ratio between pigment and binder. The effect of the presence of resins in the primer vehicle is also under test.

A preliminary study was made of the effects of variations in pigment-volume-concentration. High pigment volume is characteristic of many of the formulas.

A wide range of opaque pigments was studied. A high lead content appears in most of the formulas. Lead titanate was given considerable attention, and zinc sulfide and titanium pigments were frequently used to aid in increasing opacity.

Variations of inerts included asbestine, silica, Celite #110, dead burned calcium sulfate, mica, serecite, flake graphite, and aluminum powder.

A survey was made of the popular competitive primers on the market, and exposures made to evaluate their merits relative to the experimental developments.

The above tests were placed on exposure about August, 1935. The painting, in most instances was on 6" bevelled siding, both edge-grain white pine, and flat-grain yellow pine. The finish coat was usually SWP White (Titanium Dioxide type). The exposures are vertical, south.

For detailed information, see report, "Outline of Exterior House Paint Primer Studies," distributed at the Technical and Operating Meeting of November, 1935. Additional copies may be secured on request.

1936 Series

The 1936 series of House Paint Primer tests comprise 55 exposures to date, designed to extend the scope of the 1935 series and to cover certain phases not included in previous exposures.

In addition to a more detailed study of the new Devoe Undercoat and House Paint system, and Titanium Pigment Company's exterior primer MW-401, we have under exposure the various types of institutional primer developments such as the Lincoln lead-zinc sulfide type (21.5% pigment-volume-concentration) and the Acme lead-zinc sulfide type with higher inert content and higher pigment-volume-concentration (30.7%). Also experimental developments, including Lowe Brothers' lead-titanium dioxide type (36% p.v.c.), and a formula developed for possible usage by Sherwin-Williams, of a lead-titanium dioxide type but lower pigment-volume-concentration (28.4%). Practical tests on the latter are under way at Cleveland. Also an experimental development of a lead-leaded zinc-titanium dioxide primer for Martin-Senour at 30.5% p.v.c. The above primers are on exposure in two and three coat work, using SWP White (titanium dioxide type) as the finishing coats. Representative types of primers are also to be put out as single coats on repaint work to determine the durability of the primer films when exposed to the elements after the weathering away of the top coats.

A special development was made of a primer for pitchy yellow pine, characterized by high pigment-volume-concentration, with the opaque pigmentation a combination of lead and titanium dioxide, and the inert a combination of Celite #110 and mica to give added adhesion and sealing properties. To further study the effect of pigment-volume-concentration we adhered to the form of this yellow pine sealer but varied the pigment-volume-concentration in steps from 25% to 30%, 35% and 40%. Along the same lines, the S-W development was formulated with 33% and

35% p.v.c. We will also study the effect of variations in the percentage of inerts in the latter formula, holding the pigment-volume-concentration the same but using 10%, 20%, 30% and 40% of inerts, taking the difference from the lead content.

We are also studying special wood primers of the Cryptone MS-130 type. These range from 28% to 35% p.v.c., some containing a small amount of leaded zinc, with bodied oil-raw oil vehicles and with and without resin.

Special attention has also been given to variations of the S-W development in which flaky talcs submitted by various sources have been substituted for the Celite #110 content. Mica also appears in this series.

Special exposures in the 1936 series also include:
Acme Balanced Primer tinted to shade of Devoe's Lumilead Primer, also to SWP Ivory. Acme Balanced Primer plus 1/2 pound aluminum powder added per gallon - also with 1/2 pound aluminum powder in one gallon of primer.

We have also started an investigation of the actual pigment-volume-concentrations which exist in the films of selected primers when applied on red cedar. This is controlled by various factors, including the balance of polymerized oils to raw oils in the vehicle, the type of pigmentation as it affects absorptive and adsorptive forces, etc. Our technique has been improved to a point which indicates that our earlier results may require revision. Results to date are as follows: Lead-in-oil, regular reduction for first coat, p.v.c. of film on red cedar, 48.4%; SWP Gloss White, 7 pints oil, 1 pint turpentine, 37.5%; Lowe Brothers' Primer, 50.4%; and Devoe's Undercoat 52.3%. This work is to be continued and above figures are subject to revision.

CDH and MVL:AR