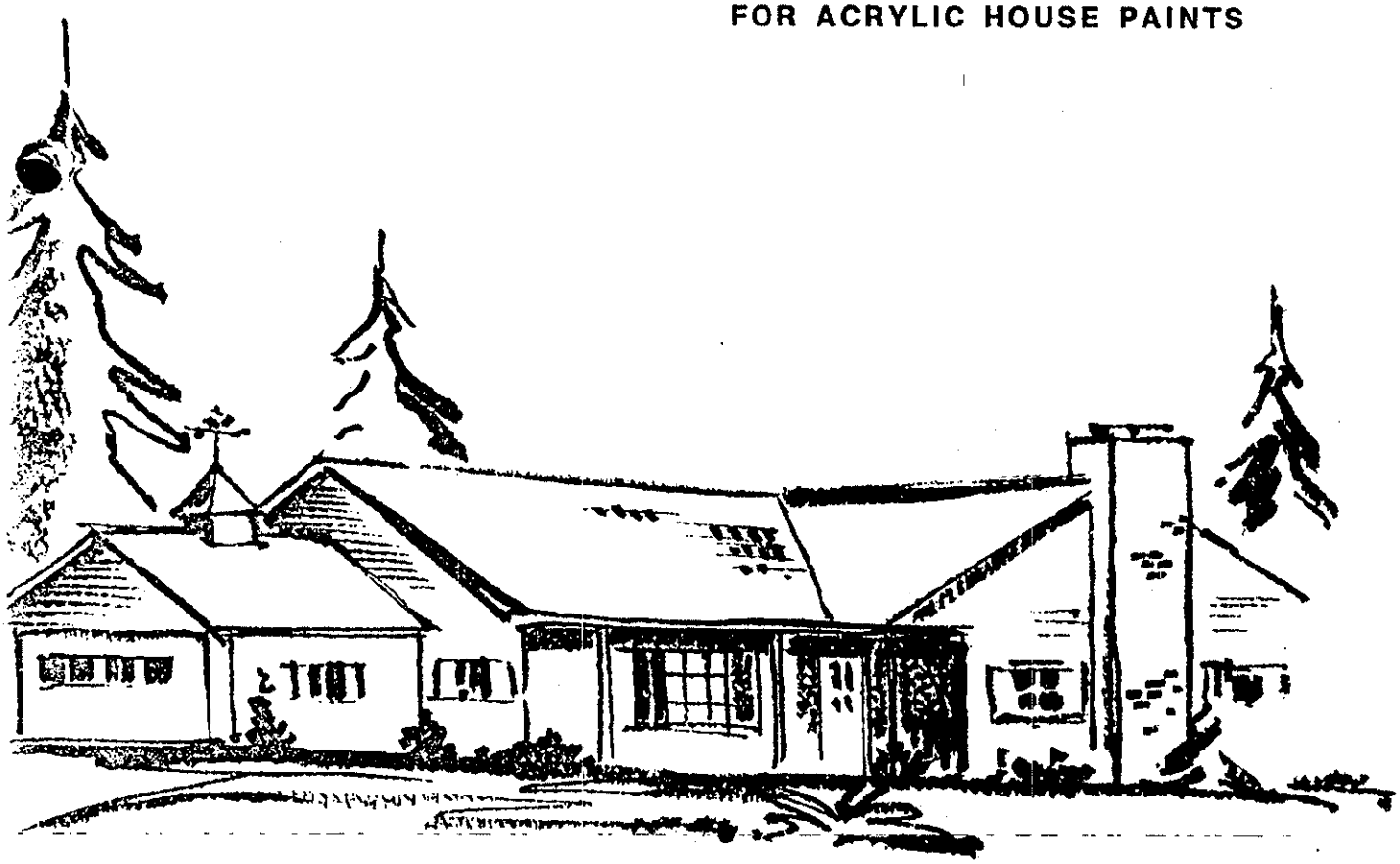
DOW

LATEX 354

FOR ACRYLIC HOUSE PAINTS



DOW

PLASTICS DEPARTMENT • THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

DOW LATEX 354 FOR ACRYLIC HOUSE PAINTS

Dow Latex 354 is an acrylic binder which has excellent adhesion characteristics compared to Dow Latex 352. In this respect it is superior to Dow Latex 352 while maintaining the other outstanding characteristics of Dow Latex 352 which have been established by successful, long term commercial use.

TYPICAL PROPERTIES OF DOW LATEX 354

Percent Solids by Weight	46 ± 0.5%
pH (as shipped)	9.5 ± 0.3
Hamilton Beach Stability	Good; 30 minutes
Surface Tension at 75°F., 50% R.H.(Dynes/cm.)	36
Freeze/Thaw Stability	Good
Latex Specific Gravity at 75°F.	1.07
Polymer Specific Gravity at 75°F.	1.15
Film Appearance at 75°F., 50% R.H.	Forms clear continuous, flexible, slightly tacky film
Film Stability to Light Exposure	Excellent
Film Stability to Heat Exposure	Excellent
Minimum Film Formation Temperature	45°F.

HANDLING AND SUGGESTED USES

Dow Latex 354 presents no special handling problems. Maximum formulation stability is obtained when the pH level is above 8.0 and it is generally recommended that formulating be done at a pH of 9.4 to 9.7. Ammonium hydroxide (14-28%) or potassium hydroxide (10%) may be used to adjust pH if necessary. The latex should be under agitation during adjustment. Exterior house paints based on Dow Latex 354 possess all of the properties normally associated with acrylic latexes and, in addition, exhibit excellent wet adhesion and blister resistance.

Dow Latex 354 was especially developed to provide improved adhesion characteristics, particularly wet adhesion, compared to Dow Latex 352. The polymer composition of Dow Latex 354 is essentially identical to that of Dow Latex 352 except for modification to provide improved adhesion, and the early history shows it to possess excellent exposure characteristics. The earliest exposure (August, 1962) of prototypes of Dow Latex 354 show performance advantages such as superior resistance to grain line cracking and greatly improved performance of higher PVC (25-35%) latex based primers on bare wood. These early data are supported by commercial results with Dow Latex 354.

TOPCOATS

The development of a latex topcoat for exterior wood requires investigation of variables affecting appearance and durability. These variables are discussed in detail below. In the handling of latex, and in the mechanics of latex paint formulation, the practices followed with Dow Latex 354 are similar to those developed for latex trade sales finishes over the last fifteen years.

A satisfactory latex paint for exterior wood should have the following attributes:

1. Excellent adhesion to all types of wood.
2. Good film strength and flexibility.
3. Sufficient low temperature flexibility to follow the dimensional changes of the substrate without film cracking or other failure.
4. Sufficient low temperature film forming ability to provide a margin of safety when paints are applied and dried at temperatures down to 40°F.
5. Prevent the passage of rain or dew on the surface into the substrate.
6. Allow moisture, passing through the wood from the inside as vapor, to be released through the paint film without any build-up of pressure behind the film.

Paint films containing Dow Latex 354 have the ability to couple adequate MVTR with unusual water resistance and excellent adhesion to wood and other sound repaint surfaces.

FORMULATION

Pigmentation

Pigment Volume Concentration - Based on extensive exposures with Dow Latex 354 and similar latexes, the suggested PVC for tint base paints is 40%. This PVC results in an optimum balance of tint retention and cleanliness properties.

For white paints, where tint retention is not a factor, exposures at 45% PVC have performed very satisfactorily.

Solids - In order to obtain maximum durability, the volume solids of paints containing Dow Latex 354 should be as high as is consistent with application characteristics and cost. The formulations suggested here were prepared at 40% volume solids.

Titanium Dioxide - To maintain a clean appearance in white paints, the amount of anatase titanium dioxide required will vary depending upon pigment volume concentration and geographical area. The white topcoat formulation suggested is a 45 PVC paint with a rutile/anatase titanium dioxide ratio of 90/10. Test fence and test house exposures have shown that 45 PVC paints offer good durability and resistance to dirt collection. The anatase level is kept relatively low to prevent excessive chalking upon aging.

Two light tint base formulations, both 40 PVC, are suggested. One of these is designated as a light tint base and contains 170 pounds of rutile titanium dioxide. The other contains 100 pounds rutile titanium dioxide and is designated as a medium tint base paint. It is suggested that paint manufacturers consider formulation of their tint bases with the least amount of titanium dioxide pigment consistent with hiding requirements and colors desired. Lesser amounts of titanium dioxide contribute to improved color retention by virtue of less chalk masking.

Zinc Oxide - If desired, zinc oxide can be used in Dow Latex 354 paints to improve mildew resistance. In the section on suggested starting point formulations a 40 PVC topcoat formulation containing 100 pounds zinc oxide is included.

Extenders - As a general rule, paints prepared with large particle size extenders exhibit good tint retention but with some sacrifice in cleanliness compared to paints prepared with extenders having higher binder demand. Thus, extender pigments should be carefully selected to achieve the optimum property balance in each particular formulation. With white topcoats, it is desirable to achieve cleanliness without excessive chalking. For tints, it is necessary to achieve a balance between tint retention and cleanliness. In our work we have found that calcium carbonate and clay pigments give good results. Talc pigments generally cause earlier chalking than the other extenders but can be used in white topcoats where tint retention is not a problem. The extender pigment selection in the starting point formulations suggested here take these properties into account.

Pigment Dispersants - Commonly used latex paint pigment dispersants are satisfactory in Dow Latex 354 paints. Dispersants such as potassium tripolyphosphate, Tamol 850, Tamol 731, and Daxad 30 are especially useful. Other surfactants such as Igapal CO 630 and Triton X-100 are also useful in combination with the above dispersants.

Protective Colloids - METHOCEL® methylcellulose has been used with excellent results in exposures of paints containing Dow Latex 354.

Hydroxyethylcellulose should also be satisfactory as a protective colloid in these paints.

Preservatives - Dow Preservative SA-1013 has been found to be particularly effective and persistent in control of mold growth on paint films containing Dow Latex 354 applied on wood and exposed in the severe environment of the Gulf Coast area. It has not imparted any susceptibility to paint film discoloration from exposures to sulfide fumes or other environmental effects.

The preservative level required for mold control will vary in different geographical areas. Levels of Dow Preservative SA-1013 required have varied with incidence of mold severity between 3 and 6 pounds per 100 gallons of paint when incorporated into both the primer and topcoat. Levels up to 9 pounds/100 gallons in the topcoat may be required in severe mold areas if applied over a molded surface or unprotected primer or undercoater.

In areas where mold potential is minimal, 1-1.5 pounds of DOWICIL® 100 preservative will provide effective package preservation.

pH - The recommended pH for paints based on Dow Latex 354 is 9.4-9.7. If adjustment is necessary, ammonium hydroxide (14 - 28%) is suggested.

Color Acceptance - To attain uniform color acceptance with aqueous color dispersions or universal tinting systems, it is sometimes necessary to add auxiliary wetting agents in the let-down or, in extreme cases to even change the pigment dispersion system. Since all colorants do not respond similarly to color acceptance aids it is impractical to suggest a specific solution that will work with all colorants. We have found that materials such as morpholine soya fatty acid, alkanolamine condensates, alkyl phenol ethylene oxide condensates and alkyl aryl sulfonates should provide a good basis for investigation.

REPAINT

Over new wood which has been primed with a blister resistant primer, topcoats containing Dow Latex 354 demonstrate excellent adhesion. However, in using the topcoat in repainting, applications over heavily chalking paints may develop questionable adhesion which in some exposures may result in eventual failure of the paint film. It is an evident, inherent disability of all high polymer emulsion systems that they will not adequately penetrate heavy chalk. Thoroughly cleaning off the heavy chalk prior to repainting with the latex system will result in good bond and durability. Also, use of a conventional solvent thinned oil system will seal the chalk to the substrate and negate the problem. However, neither of these is a "handy" method.

One approach to the problem is the addition of drying oil to a topcoat paint formulated with Dow Latex 354 and using this oil modified latex topcoat as the first coat in a repaint. The oil modified latex paint shows excellent adhesion and durability over heavily chalking weathered paints. Addition of one-half to one pint of oil per gallon of paint is adequate for heavily chalking surfaces.

Paddle mixing by either dealer or consumer is sufficient to incorporate the oil into paint containing Dow Latex 354. If slight separation occurs on standing, a few stirs with a paddle will redisperse the oil. Samples checked after one year of aging are in good and useable condition.

Boiled linseed oil has been used in laboratory and field evaluations because of its ready availability from most dealers, but other drying oils and long oil alkyds give similarly good results. Oils supplied by the paint manufacturer should contain sufficient drier and should have adequate preservative level to protect against any regional mold problems.

As the oil modified paint film made with Dow Latex 354 dries, much of the oil migrates into the chalk, firmly binding it to the unweathered paint of the previously painted surface. At lease 24 hours should be allowed before applying a second coat. For maximum appearance retention, the second coat of paint should not be oil modified.

Some paint manufacturers may find it is more desirable to produce their paints already modified rather than relying on dealer or customer addition of modifer. Both oil and long oil alkyd emulsions can be used. The recommended level of modifer is 10 to 25 percent of the nonvolatile vehicle. The use of modifiers in topcoats will generally result in some compromise of the excellent tint and color retention characteristics of paint containing Dow Latex 354.

PRIMER

Solvent Thinned Primer

The most widely used primer for new wood is a blister resistant solvent thinned primer such as will meet Interim Federal Specification TT-P-0025b. Excellent results over unpainted and previously painted wood have been obtained with this primer followed by topcoats based on Dow Latex 354.

Latex Primer

Early results with primers based on Dow Latex 354 are extremely encouraging. Complete latex systems utilizing 25-35 PVC primers based on Dow Latex 354 and longer term (2 to 3 years) exposure with prototypes of Dow Latex 354 show excellent resistance to grain line cracking and flaking.

Two primer formulations are given in this bulletin in the section on formulations. Both are formulated with basic silicate of lead pigment to prevent staining from water soluble stains in such woods as Red Cedar and Redwood. The stains still discolor the primer but, except in extreme cases, where a second coat of primer may be desirable, the stains are insolubilized by the basic silicate of lead and do not migrate into subsequent topcoats. Primer Formulation P-790-4-2 is modified with boiled linseed oil to provide improved penetration of and adhesion to chalky surfaces to provide an added margin of safety in painting such surfaces.

EXTERIOR MASONRY

The formulations suggested for exterior wood are also suitable for exterior masonry. However, higher PVC paints have exhibited excellent performance over masonry type surfaces and should be considered if the paint's application is limited to this type of surface. A 50 PVC white topcoat formulation for masonry surfaces is included in the section on formulations. To improve the adhesion of latex paints over heavily chalking exterior masonry paints (such as cement type paints), a solvent-thinned, alkali-resistant surface conditioner is recommended.

STARTING POINT FORMULATIONS

Dow Latex 354
Exterior Wood Primer, 25% PVC
Formulation P-790-3-2

Ingredients		Pounds/100 gallons
Code	**Pigment Dispersion**	
	Water	104.5
12	Pigment Dispersant (25%)	7.0
16	Non ionic Wetting Agent	3.0
19	Dow Preservative SA-1013	6.0
6	Basic Silicate White Lead	100.0
5	Titanium Dioxide, Rutile	175.0
8	Calcium Carbonate	65.9
23	Ethylene glycol	25.0
20	Dow Polyglycol P - 1200 } preblend	2.0
18	METHOCEL 90HG, 4,000 cps }	3.5
Let Down		
1	Dow Latex 354 (46%)	636.5
21	Defoamer (50%)	10.0
24	Ammonium Hydroxide (28%)	1.0
	pH, adjust to	9.4 - 9.7
	Viscosity	80 - 85 K. U.
	Pigment Volume Concentration	25%
	Volume Solids	40%
	Weight Solids	56%

GLD005803

Dow Latex 354
Exterior "Universal" Wood Primer, 25% PVC
Formulation P-790-4-2

Ingredients		Pounds/100 gallons
Code	**Pigment Dispersion**	
	Water	180.9
12	Pigment Dispersant (25%)	7.0
16	Non ionic Wetting Agent	3.0
19	Dow Preservative SA-1013	6.0
6	Basic Silicate White Lead	100.0
5	Titanium Dioxide, Rutile	175.0
8	Calcium Carbonate	65.9
23	Ethylene glycol	25.0
20	Dow Polyglycol P-1200 } preblend	2.0
18	METHOCEL 90HG, 4,000 cps	3.5
Let Down		
1	Dow Latex 354 (46%)	477.4
21	Defoamer (50%)	10.0
22	Boiled Linseed Oil } preblend	58.5
14	Anionic Wetting Agent (28%)	3.9
	pH, adjust to	9.4-9.7
	Viscosity	80-85 K. U.
	Pigment Volume Concentration	25%
	Weight Solids	55.5%
	Volume Solids	40%

GLD005804

STARTING POINT FORMULATIONS

Dow Latex 354
Experimental Exterior Topcoat,
Light Tint Base, 40% PVC
Formulation P-790-5-2

Ingredients		Pounds/100 gallons
Code	**Pigment Dispersion**	
	Water	163.1
11	Pigment Dispersant (25%)	8.0
16	Non ionic Wetting Agent	3.0
19	Dow Preservative SA-1013	6.0
4	Titonium Dioxide, Rutile	170.0
8	Calcium Carbonate	224.6
9	Clay	24.9
23	Ethylene glycol	25.0
20	Dow Polyglycol P-1200 } preblend	2.0
18	METHOCEL 90HG, 4,000 cps	3.5
Let Down		
1	Dow Latex 354 (46%)	510.0
21	Defoamer (50%)	10.0
15	Non ionic Wetting Agent (50% in alcohol)	8.0
	pH, adjust to	9.4-9.7
	Viscosity	80-85 K.U.
	Pigment Volume Concentration	40%
	Weight Solids	56.6%
	Volume Solids	40%

GLD005805

Dow Latex 354
Experimental Exterior Topcoat
Medium Tint Base, 40% PVC
Formulation P-790.6-2

Ingredients		Pounds/100 gallons
Code	**Pigment Dispersion**	
	Water	164.0
11	Pigment Dispersant (25%)	7.0
16	Non ionic Wetting Agent	3.0
19	Dow Preservative SA-1013	6.0
4	Titanium Dioxide, Rutile	100.0
8	Calcium Carbonate	265.0
9	Clay	29.5
23	Ethylene glycol	25.0
20	Dow Polyglycol P-1200 } preblend	2.0
18	METHOCEL 90HG, 4,000 cps	3.0
Let Down		
1	Dow Latex 354 (46%)	510.0
21	Defoamer (50%)	10.0
15	Non ionic Wetting Agent (50% in alcohol)	8.0
	pH, adjust to	9.4-9.7
	Viscosity	80-85 K.U.
	Pigment Volume Concentration	40%
	Weight Solids	55.7%
	Volume Solids	40%

GLD005806

STARTING POINT FORMULATIONS

Dow Latex 354
Experimental Exterior Topcoat
White, 45% PVC
Formulation P-790-8-2

Ingredients		Pounds/100 gallons
Code	**Pigment Dispersion**	
	Water	193.1
12	Pigment Dispersant (25%)	10.1
16	Non ionic Wetting Agent	3.0
19	Dow Preservative SA-1013	6.0
3	Titanium Dioxide, Rutile	207.0
2	Titanium Dioxide, Anatase	23.0
8	Calcium Carbonate	190.0
9	Clay	63.5
23	Ethylene glycol } preblend	25.0
20	Dow Polyglycol P-1200 } preblend	2.0
18	METHOCEL 90HG, 4,000 cps } preblend	3.5
Let Down		
1	Dow Latex 354 (46%)	466.8
21	Defoamer (50%)	10.0
	pH, adjust to	9.4-9.7
	Viscosity	80-85 K.U.
	Pigment Volume Concentration	45%
	Weight Solids	58.5%
	Volume Solids	40%
	Rutile to Anatase Ratio	90/10

GLD005807

Dow Latex 354
Experimental Exterior Topcoat
White (Zinc Oxide), 40% PVC
Formulation P-790-9-2

Ingredients		Pounds/100 gallons
Code	**Pigment Dispersion**	
	Water	154.0
13	Pigment Dispersant (30%)	10.0
16	Non ionic Wetting Agent	3.0
19	Dow Preservative SA-1013	6.0
3	Titanium Dioxide, Rutile	180.0
2	Titanium Dioxide, Anatase	20.0
7	Zinc Oxide, Lead Free	100.0
8	Calcium Carbonate	134.0
9	Clay	45.0
23	Ethylene glycol } preblend	40.0
20	Dow Polyglycol P-1200 } preblend	2.0
18	METHOCEL 90HG, 4,000 cps } preblend	3.5
Let Down		
1	Dow Latex 354 (46%)	510.0
21	Defoamer (50%)	10.0
	pH, adjust to	9.4-9.7
	Viscosity	80-85 K.U.
	Pigment Volume Concentration	40%
	Weight Solids	59.2%
	Volume Solids	40%
	Rutile to Anatase Ratio	90/10

STARTING POINT FORMULATIONS

Dow Latex 354
Experimental Exterior Masonry Paint
White, 50% PVC
Formulation P-790-7-2

Ingredients		Pounds/100 gallons
Code	**Pigment Dispersion**	
	Water	215.8
12	Pigment Dispersant (25%)	10.0
16	Non ionic Wetting Agent	3.0
19	Dow Preservative SA-1013	3.0
3	Titanium Dioxide, Rutile	230.0
8	Calcium Carbonate	225.0
9	Clay	75.0
23	Ethylene glycol } preblend	25.0
20	Dow Polyglycol P-1200 } preblend	2.0
18	METHOCEL 90HG, 4,000 cps } preblend	3.5
Let Down		
1	Dow Latex 354 (46%)	424.3
21	Defoamer (50%)	10.0
	pH, adjust to	9.4-9.7
	Viscosity	80-85 K.U.
	Pigment Volume Concentration	50%
	Weight Solids	59.5%
	Volume Solids	40%

GLD005809

INDEX OF MATERIALS AND SUPPLIERS

For the convenience of the reader, all raw materials mentioned in the formulations in this bulletin are arranged below in groups according to their function in a latex paint. Brand names are followed by name and address of their manufacturer, but common materials are not.

Formulators are encouraged to experiment with brands and materials other than those listed. In no sense should this list be considered restrictive. Equivalent brands and materials can be used and should give similar results.

CODE	LATEX	
1	Dow Latex 354	The Dow Chemical Company, *Midland, Michigan*
	PIGMENTS	
	Hiding Pigments	
	Anatase Titanium Dioxide	E. I. duPont de Nemours & Co., Inc.
2	Ti-Pure FF	Wilmington, Delaware
	Rutile Titanium Dioxide	E. I. duPont de Nemours & Co., Inc.
3	Ti-Pure R-610	Wilmington, Delaware
4	Ti-Pure R-960	E. I. duPont de Nemours & Co., Inc. Wilmington, Delaware
5	Titanox RANC	Titanium Pigment Corp. 111 Broadway New York, New York
	White Lead, Basic Silicate	The Eagle-Picher Co.
6	E-P 202	American Building Cincinnati, Ohio
	Zinc Oxide	The Eagle-Picher Co.
7	E-P 417	American Building Cincinnati, Ohio

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INDEX OF RAW MATERIALS SUPPLIERS

CODE	LATEX	
	Extender Pigments	
	Calcium Carbonate	
8	Snowflake White	Thompson, Weinman & Co. 52 Vanderbilt Ave. New York, New York
	Clays	
9	ASP 400	Minerals & Chemicals Philipp Corp. Essex Turnpike, Menlo Park, N. J.
	Complex Alkali Phosphates	
10	Potassium Tripolyphosphate	
	Synthetic Wetting Agents (Anionic)	
11	Daxad 30	Dewey & Almy Chemical Co. 62 Whittmore Avenue Cambridge, Mass.
12	Tamol 731	Rohm & Haas Co. 222 W. Washington Square Philadelphia 5, Pa.
13	Tamol 850	Rohm & Haas Co. 222 W. Washington Square Philadelphia 5, Pa.
14	Triton X-200	Rohm & Haas Co. 222 W. Washington Square Philadelphia 5, Pa.
	Synthetic Wetting Agents (Nonionic)	
15	Emcol 5138	Witco Chemical Co. 122 East 42nd St. New York 17, N. Y.
16	Igepal CO-630	General Anilene & Film Corp. 140 West 51 St. New York, N. Y.
17	Triton X-100	Rohm & Haas Co. 222 W. Washington Square Philadelphia 5, Pa.

GLD005811

CODE	LATEX	
	Synthetic Thickeners	
18	METHOCEL 90HG, Methylcellulose *4,000 cps*	The Dow Chemical Company *Midland, Michigan*
	Mildewcides	
19	Dow Preservative SA-1013	The Dow Chemical Company Midland, Michigan
	Defoamers	
20	Dow Polyglycol P-1200	The Dow Chemical Company Midland, Michigan
21	Nopco 1497V	Nopco Chemical Co., Inc. Newark, New Jersey
	Resin Modifiers	
	Boiled Linseed Oil	
22	Pure Boiled Linseed Oil	The Sherwin-Williams Co. 11541 S. Champlain Avenue Chicago 28, Illinois
	Solvents	
23	Ethylene Glycol	
	pH Adjustment	
24	Ammonium Hydroxide	

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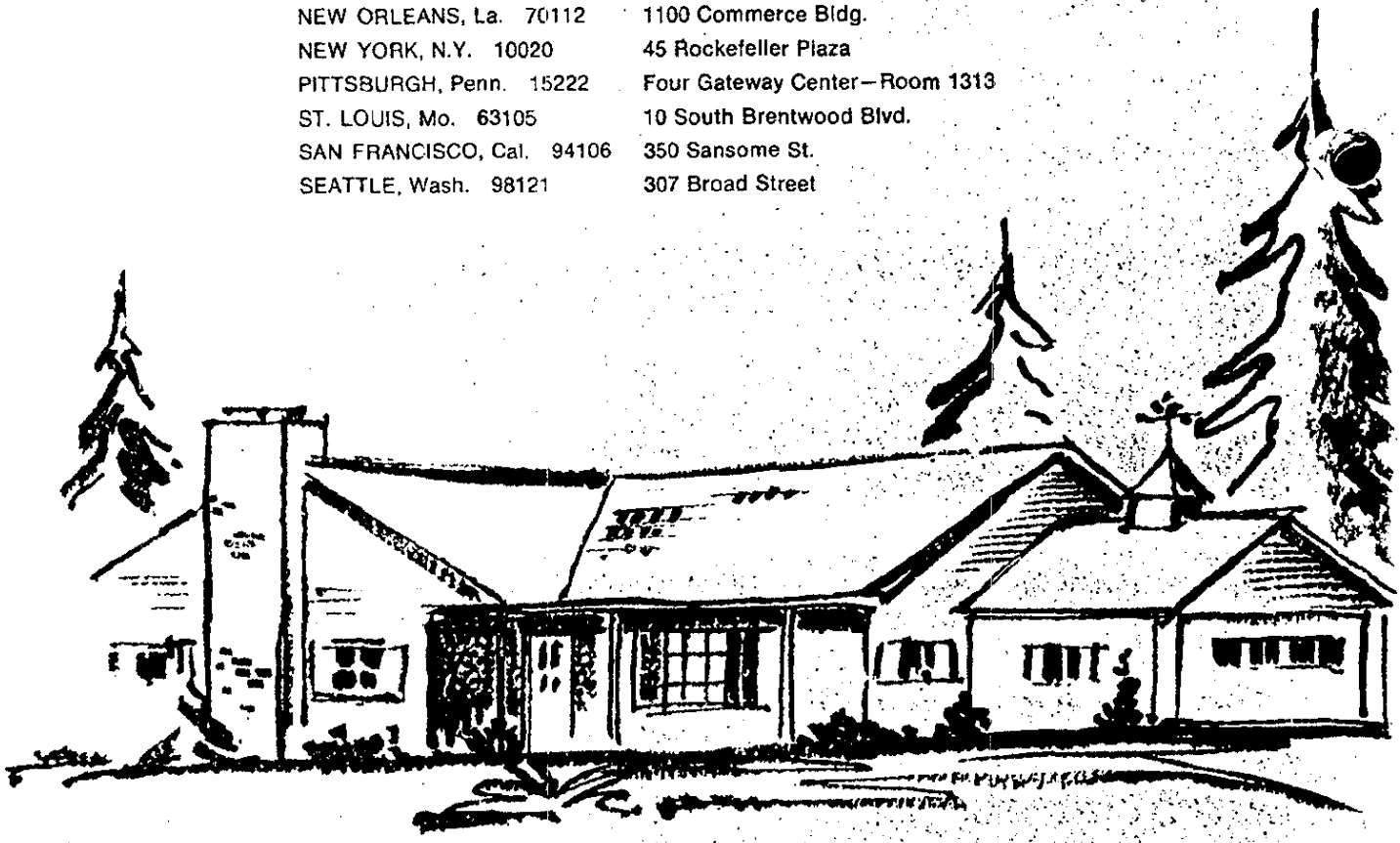

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