

House Paint Formulations

—Including Primers

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WHITE LEAD

Foreword

THIS Technical Bulletin contains suggested house paint formulations for both primer and finish coats (white and tint-base). A variety of formula types are included to meet a range of geographical, marketing and other requirements.

White lead imparts more desirable characteristics to a house paint than any other pigment. Because of its basic character it reacts with the fatty acids in the oil binder of the vehicle to form lead soaps. These lead soaps reinforce a paint film and increase its elastic strength and flexibility. White lead stabilizes paint films by neutralizing destructive chemical agents as they are formed during the weathering process. The water resistance of white lead increases the life of white lead base paints by reducing the tendency of the film to swell, soften, crack or blister. These and other important advantages of white lead base mixed pigment paints are discussed in detail in a Lead Industries Association booklet entitled "White Lead in Mixed Pigment House Paints". This booklet, available free of charge from the association, tells why white lead is vitally needed and how white lead should be used to obtain optimum results.

Additional information on white lead base house paints or on other paint problems may be obtained from the Lead Industries Association, 420 Lexington Avenue, New York 17, New York.

*White Lead Lengthens the Life
of House Paints Because:*



HOUSE PAINT FORMULATIONS

—Including Primers

PRIMER PAINTS

HOUSE paint primers prepared according to the following formulations form strongly adherent, flexible and elastic films that can withstand the stresses and strains set up by the expansion and contraction of the surface over which they are applied. They contain a sufficient amount of white lead to assure retention of enough oil binder to maintain strong cohesion and assure the establishment of a good foundation for the application of finish coats.

These primers work well over all types of commonly used woods including yellow pine. They contain sufficient hiding pigments to assure excellent coverage.

FORMULA P-1

The following is a well known and widely accepted primer formula closely approximating the requirements of Federal Specification TT-P-25a. This type of formula is well suited to the paint manufacturer lacking vehicle processing equipment.

	Pounds Non-Vol.	Total Pounds	Gallons
Basic Carbonate White Lead		267.2	4.7
Basic Sulfate White Lead		267.2	5.1
Rutile Non-Chalking Titanium Dioxide*		105.8	8.1
Barytes†		244.4	6.6
Magnesium Silicate		173.4	7.3
Litharge‡		10.6	0.1
Raw Linseed Oil	159.8	159.8	20.7
Bodied Linseed Oil (Z-4)	143.3	143.3	17.7
Ester Gum Cold Cut (10 lb.)	22.0	36.4	(2.4 NV) 4.6
Cobalt Naphthenate (8%)		2.5	0.3
Mineral Spirits		208.2	31.8
		1,618.8	102.0

Pigment	= 66.0%
Vehicle	= 34.0
P.V.C.	= 39.7
Pig./Gal. Paint	= 10.5 lbs.
Consistency	= 86 ± 2 K.U.

PIGMENT ANALYSIS

Basic Carbonate White Lead	25.0%
Basic Sulfate White Lead	25.0%
Rutile Non-Chalking Titanium Dioxide	9.9%
Barytes	22.9%
Magnesium Silicate	16.2%
Litharge	1.0%
	100.0%

VEHICLE ANALYSIS

Vegetable Oil	55.1%
Resins	4.0%
Thinner & Drier	40.9%
	100.0%

* Anatase type permitted.

† About 10% silica may be used to replace barytes and/or magnesium silicate to control gloss.

‡ The 10.6 lbs. of litharge may be replaced by 40.8 lbs. (4.3 gals.) of lead naphthenate (24%) and compensation made by adjusting the mineral spirits content.

FORMULA P-1

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FORMULAS P-2 AND P-3

The following Formulas P-2 and P-3 are both quality primer formulations containing substantial proportions of white lead and titanium dioxide. The manufacturers selection of one or the other of these formulas might depend on the raw material supply situation at any given time. These formulas contain vehicles that require no special processing equipment.

**FORMULA
P-2****Formula P-2**

	<u>Pounds Non-Vol.</u>	<u>Total Pounds</u>	<u>Gallons</u>
White Lead		553.7	9.8
Rutile Non-Chalking Titanium Dioxide		74.6	2.1
Magnesium Silicate*		292.1	12.3
Litharge†		9.2	0.1
Raw Linseed Oil	165.0	165.0	21.3
Ester Gum Cold Cut (10 lb.)	22.7	37.6	4.7
Low Acid Heat Bodied Linseed Oil (Z2 to Z4)	147.8	147.8	18.2
Cobalt Naphthenate (6%)		2.8	0.4
Mineral Spirits		215.5	33.1
		1498.3	102.0

Pigment	= 62.0%
Vehicle	= 38.0%
P.V.C.	= 36.7
Pig./Gal. Paint	= 9.1 lbs.
Consistency	= 80 ± 2 K.U.

PIGMENT ANALYSIS

White Lead	59.6%
Rutile Non-Chalking Titanium Dioxide	8.0%
Magnesium Silicate	31.4%
Litharge	1.0%
	100.0%

VEHICLE ANALYSIS

Vegetable Oil	55.0%
Resins	4.0%
Thinner & Drier	41.0%
	100.0%

* 10% silica may be used to cut gloss if desired.

† The 9.2 lbs. litharge may be replaced by 85.4 lbs. (8.7 gals.) of lead naphthenate (24%) and compensation made by adjusting the mineral spirits content.

**FORMULA
P-3****Formula P-3**

	<u>Pounds Non-Vol.</u>	<u>Total Pounds</u>	<u>Gallons</u>
White Lead		363.8	6.7
Rutile Non-Chalking Titanium Dioxide		106.4	3.1
Magnesium Silicate*		409.4	17.1
Litharge†		8.9	0.1
Raw Linseed Oil	159.7	159.7	20.5
Ester Gum Cold Cut (10 lb.)	22.0	36.4	(2.4 NV) 4.5
Low Acid Heat Bodied Linseed Oil (Z2 to Z4)	143.1	143.1	17.6
Cobalt Naphthenate (6%)		2.8	0.4
Mineral Spirits		208.6	32.0
		1439.1	102.0

Pigment	= 61.7%
Vehicle	= 38.3%
P.V.C.	= 40.0
Pig./Gal. Paint	= 8.7 lbs.
Consistency	= 76 ± 2 K.U.

PIGMENT ANALYSIS

White Lead	40.9%
Rutile Non-Chalking Titanium Dioxide	12.0%
Magnesium Silicate	46.1%
Litharge	1.0%
	100.0%

VEHICLE ANALYSIS

Vegetable Oil	55.0%
Resins	4.0%
Thinner & Drier	41.0%
	100.0%

* 10% silica may be used to cut gloss if desired.

† The 8.9 lbs. of litharge may be replaced by 84.4 lbs. (3.6 gals.) of lead naphthenate (24%) and compensation made by adjusting the mineral spirits content.

FORMULA P-4

This is a formula for a high titanium content white lead base primer having exceptionally good hiding characteristics. This formula is particularly suitable for adoption by manufacturers equipped with oil processing and varnish making equipment.

	<u>Pounds Non-Vol.</u>	<u>Total Pounds</u>	<u>Gallons</u>
White Lead		472.8	8.7
Rutile Non-Chalking Titanium Dioxide		147.7	4.2
Magnesium Silicate		344.7	14.5
Litharge†		9.8	0.1
Raw Linseed Oil	187.0	187.0	24.1
VM 1767§	80.0	112.7	14.8
VM 1693‡	34.1	58.0	7.5
Blown Linseed Oil (Z-2)	26.8	26.8	3.3
Cobalt Naphthenate (6%)		2.8	0.4
Mineral Spirits		159.5	24.4
		1521.8	102.0

Pigment = 64.1%
 Vehicle = 35.9%
 P.V.C. = 39.4
 Pig./Gal. Paint = 9.6 lbs.
 Consistency = 96 ± 2 K.U.

PIGMENT ANALYSIS

White Lead	48.5%
Rutile Non-Chalking Titanium Dioxide	15.1%
Magnesium Silicate	35.4%
Litharge	1.0%
	100.0%

VEHICLE ANALYSIS

Vegetable Oil	52.6%
Resins	7.4%
Thinner & Drier	40.0%
	100.0%

* 10% silica may be used to cut gloss if desired.

† The 9.8 lbs. of litharge may be replaced by 37.9 lbs. (3.9 gals.) of lead naphthenate (24%) and compensation may be made by adjusting the mineral spirits content.

§ 60 parts linseed and 40 parts dehydrated castor oil bodied to obtain a viscosity of V Gardner at 70% solids in mineral spirits.

‡ 5 gallon length low acid ester gum varnish cooked with dehydrated castor oil, viscosity is B-C Gardner at 59% non-volatile content.

FORMULA P-5

This is a lower cost formula having good hiding properties. The vehicle constituents require the use of oil processing and varnish making equipment.

	<u>Pounds Non-Vol.</u>	<u>Total Pounds</u>	<u>Gallons</u>
White Lead		367.6	6.5
Rutile Non-Chalking Calcium Titanium		285.8	10.5
Magnesium Silicate		245.3	10.3
Litharge†		9.0	0.1
Raw Linseed Oil	187.2	187.2	24.1
VM 1767§	80.1	112.3	14.8
VM 1693‡	34.2	58.1	7.5
Blown Linseed Oil (V-2)	26.8	26.8	3.3
Cobalt Naphthenate (6%)		2.7	0.4
Mineral Spirits		159.8	24.5
		1455.1	102.0

Pigment = 62.4%
 Vehicle = 37.6%
 P.V.C. = 39.5
 Pig./Gal. Paint = 8.9 lbs.
 Consistency = 90 ± 2 K.U.

PIGMENT ANALYSIS

White Lead	40.5%
Rutile Non-Chalking Calcium Titanium	31.5%
Magnesium Silicate	27.0%
Litharge	1.0%
	100.0%

VEHICLE ANALYSIS

Vegetable Oil	52.6%
Resins	7.4%
Thinner & Drier	40.0%
	100.0%

* 10% silica may be used to cut gloss if desired.

† The 9.0 lbs. of litharge may be replaced by 34.3 lbs. (3.6 gals.) of lead naphthenate (24%) and compensation may be made by adjusting the mineral spirits content.

§ 60 parts linseed and 40 parts dehydrated castor oil bodied to obtain a viscosity of V Gardner at 70% solids in mineral spirits.

‡ 5 gallon length low acid ester gum varnish cooked with dehydrated castor oil, viscosity is B-C Gardner at 59% non-volatile content.

FORMULA P-4**FORMULA P-5**

FINISH PAINTS

FINISH paints prepared according to the following formulations form tough, water resistant films able to withstand the destructive effects of moisture, sunlight and abrasive agents. They are stabilized with white lead to neutralize effectively acidic compositions formed during the weathering process:

The white base paints are formulated to chalk at the proper rate to form "self-cleaning" films. As a result good appearance is maintained throughout the protective life of the film and a minimum of preparation is required for eventual repainting.

The tint base paints are also formulated to prevent the accumulation of excessive dirt. However their rate of chalking is sufficiently slow to maintain good color retention. The effectiveness of white lead in holding the oil binder in the film is an important factor in retaining the bright appearance of the tints.

FORMULAS H-1, AND H-1T

These are high quality house paint formulas carrying a substantial proportion of white lead. This combination of white lead and the high ratio of raw oil in the vehicle assures easy brushing and a high degree of foolproofness when applied under somewhat adverse conditions. The zinc oxide content, with the white lead present, is sufficient to give reasonably good control of mildew.

If the consistency is slightly low adjustment may be made by introducing one-quarter to one-half gallon of Z-8 bodied oil in place of the Z-2 to Z-3 oil. This should preferably be added to the milling base, as it aids dispersion.

FORMULA H-1

Formula H-1

	<i>Pounds Non-Vol.</i>	<i>Total Pounds</i>	<i>Gallons</i>
White Lead		298.0	5.5
Zinc Oxide		262.0	5.6
Anatase Free-Chalking Titanium Dioxide*		140.0	4.3
Magnesium Silicate		225.0	9.5
Raw or Refined Linseed Oil	282.0	282.0	36.5
Bodied Linseed Oil (Z-2 to Z-3)	124.0	124.0	15.5
Lead Naphthenate (24%)		6.7	0.7
Manganese Naphthenate (6%)		1.2	0.2
Mineral Spirits		158.0	24.2
		1494.9	102.0

Pigment = 61.7%
Vehicle = 38.3%
P.V.C. = 32.4
Fig./Gal. Paint = 9.2 lbs.
Consistency†

PIGMENT ANALYSIS

White Lead	32.1%
Zinc Oxide	28.3%
Anatase Free-Chalking Titanium Dioxide	15.2%
Magnesium Silicate	24.4%

100.0%

VEHICLE ANALYSIS

Raw or Refined Linseed Oil	49.3%
Bodied Linseed Oil (Z-2 to Z-3) ..	21.7%
Thinner and Drier	29.0%

100.0%

* The free-chalking anatase titanium dioxide may be replaced in whole or in part by semi-non-chalking anatase to reduce chalking and erosion with some increase in dirt collection.

† The consistency of this paint will vary depending upon the raw materials used. The oil content may be altered slightly to improve working properties.

Formula H-1T (Tint Base)

	<u>Pounds Non-Vol.</u>	<u>Total Pounds</u>	<u>Gallons</u>
White Lead		296.0	5.5
Zinc Oxide		262.0	5.6
Rutile Non-Chalking Titanium Dioxide		112.0	3.2
Magnesium Silicate		251.0	10.6
Raw Linseed Oil	282.0	282.0	36.5
Bodied Linseed Oil (Z-2 to Z-3)	124.0	124.0	15.5
Lead Naphthenate (24%)		6.7	0.7
Manganese Naphthenate (6%)		1.2	0.2
Mineral Spirits		153.0	24.2
		1492.9	102.0

Pigment = 61.7%
 Vehicle = 38.3%
 P.V.C. = 32.3
 Pig./Gal. Paint = 9.2 lbs.
 Consistency*

PIGMENT ANALYSIS

White Lead	32.1%
Zinc Oxide	28.4%
Rutile Non-Chalking Titanium Dioxide	12.2%
Magnesium Silicate	27.3%
	100.0%

VEHICLE ANALYSIS

Raw or Refined Linseed Oil	49.3%
Bodied Linseed Oil (Z-2 to Z-3) ..	21.7%
Thinner and Drier	29.0%
	100.0%

* The consistency of this paint will vary depending upon the raw materials used. The oil content may be altered slightly to improve working properties.

FORMULAS H-2 AND H-2T

These formulas are designed to give good clean-up where dirt collection is a problem and at the same time reduce erosion in areas where this is an important factor. The white lead content of this formula helps to control both of these factors simultaneously. The ratio of lead pigment and zinc oxide is in a range to give fair mildew resistance.

Where dirt collection is not a factor, a semi-non-chalking titanium pigment might be preferred to cut down erosion further.

Formula H-2

	<u>Pounds Non-Vol.</u>	<u>Total Pounds</u>	<u>Gallons</u>
White Lead		243.0	4.5
Zinc Oxide		302.0	6.5
Anatase Free-Chalking Titanium Dioxide*		180.0	4.0
Magnesium Silicate		300.0	12.6
Raw or Refined Linseed Oil	320.0	320.0	41.4
Bodied Linseed Oil (Z-2 to Z-3)	105.0	105.0	13.1
Lead Naphthenate (24%)		6.9	0.7
Manganese Naphthenate (6%)		1.2	0.2
Mineral Spirits		124.0	19.0
		1532.1	102.0

Pigment = 63.5%
 Vehicle = 36.5%
 P.V.C. = 33.8
 Pig./Gal. Paint = 9.6 lbs.
 Consistency†

PIGMENT ANALYSIS

White Lead	24.9%
Zinc Oxide	31.0%
Anatase Free-Chalking Titanium Dioxide	13.3%
Magnesium Silicate	30.8%
	100.0%

VEHICLE ANALYSIS

Raw or Refined Linseed Oil	57.4%
Bodied Linseed Oil (Z-2 to Z-3) ..	18.8%
Thinner and Drier	23.8%
	100.0%

* The free-chalking anatase titanium dioxide may be replaced in whole or in part by semi-non-chalking anatase to reduce chalking and erosion with some increase in dirt collection.

† The consistency of this paint will vary depending upon the raw materials used. The oil content may be altered slightly to improve working properties.

FORMULA H-1T (Tint Base)

FORMULA H-2

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**FORMULA
H-2T
(Tint Base)**
**Formula H-2T
(Tint Base)**

	<u>Pounds Non-Vol.</u>	<u>Total Pounds</u>	<u>Gallons</u>
White Lead		243.0	4.5
Zinc Oxide		302.0	6.5
Rutile Non-Chalking Titanium Dioxide		105.0	3.0
Magnesium Silicate		325.0	13.8
Raw Linseed Oil	320.0	320.0	41.4
Bodied Linseed Oil (Z-2 to Z-3)	105.0	105.0	13.1
Lead Naphthenate (24%)		6.9	0.7
Manganese Naphthenate (6%)		1.2	0.2
Mineral Spirits		124.0	19.0
		1532.1	102.0

Pigment = 63.5%
Vehicle = 36.5%
P.V.C. = 33.8
Pig./Gal. Paint = 9.7 lbs.
Consistency*

PIGMENT ANALYSIS

White Lead	24.9%
Zinc Oxide	31.0%
Rutile Non-Chalking Titanium Dioxide	10.8%
Magnesium Silicate	33.3%
	100.0%

VEHICLE ANALYSIS

Raw Linseed Oil	57.4%
Bodied Linseed Oil (Z-2 to Z-3) ..	18.8%
Thinner and Drier	23.8%
	100.0%

* The consistency of this paint will vary depending upon the raw materials used. The oil content may be altered slightly to improve working properties.

FORMULAS H-3 AND H-3T

These formulas will give good clean-up, even on the north side, without excessive erosion. This paint is relatively free brushing since it is intermediate between a typical high-bodied-oil type formula and the typical raw oil formula used in the pre-war era.

Where dirt collection is not a problem semi-non-chalking titanium pigment might be used to advantage in the white base formula.

**FORMULA
H-3**
Formula H-3

	<u>Pounds Non-Vol.</u>	<u>Total Pounds</u>	<u>Gallons</u>
White Lead		210.0	3.8
Zinc Oxide		295.0	6.4
Anatase Free-Chalking Titanium Dioxide*		140.0	4.4
Magnesium Silicate		300.0	12.6
Raw or Refined Linseed Oil	290.0	290.0	37.5
Bodied Linseed Oil (Z-2 to Z-3)	124.0	124.0	15.5
Lead Naphthenate (24%)		6.1	0.6
Manganese Naphthenate (6%)		0.9	0.1
Mineral Spirits		136.9	21.1
		1502.9	102.0

Pigment = 62.9%
Vehicle = 37.1%
P.V.C. = 33.8
Pig./Gal. Paint = 9.5 lbs.
Consistency†

PIGMENT ANALYSIS

White Lead	22.2%
Zinc Oxide	31.2%
Anatase Free-Chalking Titanium Dioxide	14.8%
Magnesium Silicate	31.8%
	100.0%

VEHICLE ANALYSIS

Raw or Refined Linseed Oil	52.0%
Bodied Linseed Oil (Z-2 to Z-3) ..	22.2%
Thinner and Drier	25.8%
	100.0%

* The free-chalking anatase titanium dioxide may be replaced in whole or in part by semi-non-chalking anatase to reduce chalking and erosion with some increase in dirt collection.

† The consistency of this paint will vary depending upon the raw materials used. The oil content may be altered slightly to improve working properties.

Formula H-3T (Tint Base)

	<u>Pounds Non-Vol.</u>	<u>Total Pounds</u>	<u>Gallons</u>
White Lead		210.0	3.9
Zinc Oxide		295.0	6.4
Rutile Non-Chalking Titanium Dioxide		112.0	3.2
Magnesium Silicate		326.0	13.7
Raw Linseed Oil	290.0	290.0	37.5
Bodied Linseed Oil (Z-2 to Z-3)	124.0	124.0	15.5
Lead Naphthenate (24%)		6.1	0.6
Manganese Naphthenate (6%)		0.9	0.1
Mineral Spirits		136.9	21.1
		1500.9	102.0

Pigment = 62.7%
 Vehicle = 37.3%
 P.V.C. = 33.8
 Pig./Gal. Paint = 9.4 lbs.
 Consistency*

PIGMENT ANALYSIS

White Lead	22.2%
Zinc Oxide	31.2%
Rutile Non-Chalking Titanium Dioxide	11.9%
Magnesium Silicate	34.7%
	100.0%

VEHICLE ANALYSIS

Raw Linseed Oil	52.0%
Bodied Linseed Oil (Z-2 to Z-3) ..	22.2%
Thinner and Drier	25.8%
	100.0%

* The consistency of this paint will vary depending upon the raw materials used. The oil content may be altered slightly to improve working properties.

FORMULAS H-4 AND H-4T

These are economy formulas designed to give as good performance as possible with a low lead content. The relatively high PVC (35) coupled with the high-bodied oil content insures relatively good cleanup but without excessive erosion. These formulas carry sufficient oil to insure good brushing properties.

In the case of the white base formula erosion can be reduced at the expense of dirt collection by utilizing semi-non-chalking titanium pigment.

Formula H-4

	<u>Pounds Non-Vol.</u>	<u>Total Pounds</u>	<u>Gallons</u>
White Lead		163.0	3.0
Zinc Oxide		302.0	6.5
Anatase Free-Chalking Titanium Dioxide*		190.0	4.0
Magnesium Silicate		321.0	13.5
Raw or Refined Linseed Oil	251.2	251.2	32.5
Bodied Linseed Oil (Z-2 to Z-3)	140.0	140.0	17.5
Lead Naphthenate (24%)		6.4	0.7
Manganese Naphthenate (6%)		1.1	0.1
Mineral Spirits		157.2	24.2
		1471.9	102.0

Pigment = 62.2%
 Vehicle = 37.8%
 P.V.C. = 35
 Pig./Gal. Paint = 9.1 lbs.
 Consistency†

PIGMENT ANALYSIS

White Lead	17.8%
Zinc Oxide	33.0%
Anatase Free-Chalking Titanium Dioxide	14.2%
Magnesium Silicate	35.0%
	100.0%

VEHICLE ANALYSIS

Raw or Refined Linseed Oil	45.2%
Bodied Linseed Oil (Z-2 to Z-3) ..	25.2%
Thinner and Drier	29.6%
	100.0%

* The free-chalking anatase titanium dioxide may be replaced in whole or in part by semi-non-chalking anatase to reduce chalking and erosion with some increase in dirt collection.

† The consistency of this paint will vary depending upon the raw materials used. The oil content may be altered slightly to improve working properties.

FORMULA H-3T (Tint Base)

FORMULA H-4

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**FORMULA
H-4T
(Tint Base)**

**Formula H-4T
(Tint Base)**

	<u>Pounds Non-Vol.</u>	<u>Total Pounds</u>	<u>Gallons</u>
White Lead		163.0	3.0
Zinc Oxide		302.0	6.5
Rutile Non-Chalking Titanium Dioxide		105.0	3.0
Magnesium Silicate		345.0	14.5
Raw Linseed Oil	251.2	251.2	32.5
Bodied Linseed Oil (Z-2 to Z-3)	140.0	140.0	17.5
Lead Naphthenate (24%)		6.4	0.7
Manganese Naphthenate (6%)		1.1	0.1
Mineral Spirits		157.2	24.2
		<u>1470.9</u>	<u>102.0</u>

Pigment = 62.2%
 Vehicle = 37.8%
 P.V.C. = 35
 Pig./Gal. Paint = 9.1 lbs.
 Consistency*

PIGMENT ANALYSIS

White Lead	17.8%
Zinc Oxide	33.0%
Rutile Non-Chalking Titanium Dioxide	11.5%
Magnesium Silicate	37.7%
	<u>100.0%</u>

VEHICLE ANALYSIS

Raw Linseed Oil	45.2%
Bodied Linseed Oil (Z-2 to Z-3) ..	25.2%
Thinner and Drier	29.6%
	<u>100.0%</u>

* The consistency of this paint will vary depending upon the raw materials used. The oil content may be altered slightly to improve working properties.

The formulations contained in this Technical Bulletin have been established through careful evaluation. However because of possible variations in raw materials and in application procedures no guarantee of results can be made or implied.

The Lead Industries Association will be glad to furnish further information on house paints or to assist on other paint problems.