
THE NATIONAL BUREAU OF STANDARDS
UNITED STATES DEPARTMENT OF COMMERCE
WASHINGTON, D. C.

September 18, 1936

FEDERAL SPECIFICATION READY-MIXED PAINTS,
SEMIPASTE PAINTS AND MIXING FORMULAS

This is primarily a digest of the sections of Bureau of Standards Technologic Paper No. 274 (December 15, 1924), "Use of United States Government Specification Paints and Paint Materials,"¹ by P. H. Walker and E. F. Hickson, and Letter Circular No. 333 (July 11, 1932), "Outside House Painting";² dealing with Federal Specification ready-mixed paints, semipaste paints, and typical formulas for mixing paints from semipaste paints.

The following papers contain additional information relative to paint, paint pigments, oil paints, and water paints:

- TIEM - 30 "Paint Pigments - White"
- TIEM - 31 "Paint Pigments - Black, Red, and Lakes"
- TIEM - 32 "Paint Pigments - Yellow, Brown, Blue, Green,
and Bronze"
- TIEM - 33 "Federal Specification Paint Pigments and
Mixing Formulas"
- TIEM - 35 "Preparation of Paints from Paste and Dry
Pigments"
- TIEM - 36 "Preparation of Paints from Semipaste Paints,
Thinning Ready-Mixed Paints, and Preparation
of Water Paints"
- TIEM - 43 "Aluminum Paints"

¹Available from Superintendent of Documents, Government Printing Office, Washington, D. C. (Price 10 cents).

²Available from the National Bureau of Standards, Washington, D. C. (Free).

Ready-mixed paints as compounded are intended to be used for final coats, or for one coat repainting if the previously painted surface is in good condition. High grade ready-mixed paints produced by a reliable paint manufacturer, if intelligently selected, may be expected to give entire satisfaction. High grade service should not be expected from low value products.

When skilled supervision is not available, it is frequently best to use ready-mixed paint, since the manufacturer's label provides simple directions for reducing such paints for priming coats and body coats. For priming coats, ready-mixed paints require considerable thinning with oil or other vehicles. Body coats should be reduced to provide a slightly flat surface in order to furnish a firm anchorage for the final coat.

Caution: Driers should not be added to ready-mixed paints.

Semipaste paints may be poured from the container and are, therefore, easier to break up than paste pigments which are quite stiff. When more than one coat is required and the work is to be done under skilled supervision, it is generally advisable to purchase semipaste paint.

Flat washable wall paints generally owe their success to the use of tung oil varnishes and heavy petroleum spirits, and can be successfully compounded only in plants properly equipped for such purposes. As produced by many manufacturers they give satisfactory results in appearance and wearing qualities. They also cost less than ordinary paints.

Federal specifications, approved by the Director of Procurement, are binding upon and govern all executive departments and independent establishments of the Federal Government in the purchase of supplies, with due regard to available types, grades, and sizes.¹

White and Tinted Paints made on a Lead-Zinc Base,
Ready-Mixed and Semipaste

Federal Specification, TT-P-36 "Paints; Lead-Zinc Base, Ready-Mixed and Semipaste, White and Tinted", covers the grade of linseed oil and white and tinted paints made on a lead-zinc base suitable for outside use. With tints it is advisable to agree upon a standard sample for color.

Lead Zinc Paint Mixing Formulas: Formulas No. 17, 18, 19, 20 and 21 (page 7 of this digest) have been found satisfactory in producing lead-zinc mixed paints for various uses, from semipaste white and tinted paints.

¹Copies of all Federal Specifications mentioned in this digest may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C. (Price 5 cents each).

Plaster Primer and Sealer

Federal Specification TT-P-56 "Paint; (For) Priming Plaster Surfaces (Plaster Primer & Sealer)", covers one grade of ready-mixed white paint of bodied oil or varnish type for interior use as a primer on old or new unpainted plaster surfaces. Complete information regarding this paint will be found in TIRM-11, "Paint for Priming Plaster Surfaces."

Titanium-Zinc and Titanium-Zinc-Lead Outside, Ready-Mixed, White Paint

Federal Specification, TT-P-101a "Paint; Titanium-Zinc and Titanium-Zinc-Lead, Outside, Ready-Mixed, White" covers one class (ready-mixed) composed of two types of outside white paint containing titanium dioxide:

Type A: Titanium-zinc-lead ready-mixed oil paint, for general outside use; white only.

Type B: Titanium-zinc, lead free, ready-mixed oil paint for special outside use where sulphide fumes will darken paints containing lead; white only.

These paints should not be tinted, as colors added to them have a tendency to "fade".

Pigment: The pigment of the titanium-zinc-lead ready-mixed oil paint, type A, shall contain by weight, not less than 7 percent of titanium dioxide, not more than 25 percent of zinc oxide, not less than 58 percent of white lead equivalent to basic carbonate white lead, and not more than 10 percent extenders (white silicate pigments, barium sulphate or mixture thereof). In this pigment the lead and zinc pigments may be introduced in the form of any preferred mixture of basic carbonate white lead, basic sulphate white lead; leaded zinc oxide, or zinc oxide. The sum of the white lead, titanium dioxide, and zinc oxide shall in no case be less than 90 percent of the total pigment.

The titanium-zinc (lead free) ready-mixed oil paint, type B, shall contain by weight not less than 15 percent titanium dioxide, not less than 30 percent nor more than 35 percent zinc oxide, and not more than 55 percent extenders.

Iron Oxide and Iron Hydroxide Paints, Ready-Mixed and Semipaste

Federal Specification, TT-P-31 "Paints; Iron-Hydroxide and Iron-Oxide, Ready-Mixed and Semipaste", covers one grade of linseed oil, iron oxide and iron hydroxide paints. It is advisable to agree upon a standard sample for color.

Iron Oxide Paint Mixing Formulas: Formulas No. 22, 23, 24, 25 and 26 (page 7) are typical examples for mixing paints from semipaste iron oxide paints.

Characteristics and Use: This type of paint is inexpensive and durable, being one of the best paints for a final color coat on iron and steel which has previously received protective coats of red lead. It is the most commonly used paint for metal roofs and is also an excellent paint for wood where the color is not objectionable.

Black Paint; Ready-Mixed and Semipaste

Federal Specification, TT-P-61 "Paint; Ready-Mixed, and Semipaste Black", covers one grade of linseed oil black paint.

Black Paint Mixing Formulas: Formulas No. 27, 28, 29 and 30 (page 7) are suitable for mixing paint from semipaste black paint.

Characteristics and Use: This is an inexpensive but durable oil paint suitable for use whenever a black linseed oil paint is required. It has such excellent hiding power that on previously painted surfaces a single coat is frequently sufficient. Either the ready-mixed paint or paint mixed from the semipaste may generally be used with equally satisfactory results.

Green Paint, Ready-Mixed and Semipaste

Federal Specification, TT-P-71 "Paints; Ready-Mixed and Semipaste, Green", covers the grade of linseed oil green paints known commercially as commercial chrome green paints. It is necessary to agree upon a standard sample for color and hiding power.

Green Paint Mixing Formulas: Formulas No. 31, 32, 33 and 34 (page 7) are suitable for mixing paint from semipaste green paint.

Characteristics and Use: This is the common chrome green-linseed oil paint generally used on window blinds, lawn benches, etc. The paint has excellent hiding power on previously painted surfaces, one coat generally being sufficient and more than two coats seldom necessary. An uncontrollable defect in practically all green paints is their tendency to change somewhat in color on weathering, some lots becoming more bluish and some more yellowish. Either the ready-mixed paint or the reduced semipaste may generally be used with equally satisfactory results.

Olive Drab Paint, Ready-Mixed and Semipaste

Federal Specification, TT-P-81 "Paints; Ready-Mixed, and Semipaste, Olive Drab", covers the grade of linseed oil olive drab paint suitable for outside use. It is advisable to agree upon a standard sample for color.

Olive Drab Paint Mixing Formulas: Formulas No. 35, 36, 37, 38 and 39 (page 7) are suitable for mixing semipaste olive drab paints for various uses.

Characteristics and Use: This is a linseed oil paint of excellent durability and hiding power. On previously painted surfaces, one coat work is frequently satisfactory.

Water-Resisting Red Enamel

Federal Specification, TT-E-531a "Enamel; Water-Resisting, Red." Where very close matching of different deliveries is required, it may only be obtained by having a mutually agreed upon sample for comparison.

Characteristics and Use: This is a varnish paint. The material desired under this specification is an extremely durable, highest quality red enamel, suitable primarily for outside use. Water-resisting red enamel is recommended for outdoor and indoor general use whenever a bright red durable enamel paint is desired.

Interior Flat Eggshell Oil Paints, White and Light Tints, Ready-Mixed and Semipaste

Federal Specification, TT-P-51 "Paints; Oil, Interior, Eggshell Flat Finish, Ready-Mixed and Semipaste, Light Tints and White", covers one grade of interior eggshell finish paint, not intended for outside use. Where tints are desired it is advisable to agree upon a standard sample for color and appearance.

Ready-Mixed Paint: This form is frequently known as flat or eggshell wall paint, and is not generally suitable for making a stipple finish. As compounded it should be suitable for body and finish coat work. For priming coats on walls add to each gallon, from one quart to one gallon of boiled linseed oil.

Semipaste Paint: This form is intended for a variety of uses, including stipple finishes. The amount of thinning liquids added may be varied to suit the particular conditions under which the material is to be used.

For nearly flat top coats add to each gallon of paste about five pints of turpentine or volatile mineral spirits. For other finishes a thinning mixture of equal volumes of boiled linseed oil and turpentine or volatile mineral spirits should be used.

For eggshell gloss top coats add about seven pints of the thinning mixture to one gallon of the semipaste.

For first coat on unpainted walls mix equal volumes of thinning mixture and the semipaste.

For stipple finishes add three pints of the thinning mixture to one gallon of semipaste.

Application and Characteristics: Unlike linseed oil paints, these flat wall paints are flowed on like varnish and enamel, with as little brushing out as possible. They set to touch very rapidly (often within one hour) and dry to practically flat films with a slight sheen, free of brush marks, laps, etc.

Washing: While all paints meeting this specification may be washed, there is considerable difference in the ease of washing of different paints. No wall paint is in suitable condition for severe washing until at least 30 days after application. A gloss paint is more washable than a flat paint.

Comparison Paints: The following comparison paints are standard only for comparison of working (brushing) properties, texture, and appearance. They are not standard for brightness, color, hiding power or composition.

Comparison Paints

Ingredients	:Minimum	:Maximum
	:Gloss Paint	:Gloss Paint
Basic Carbonate White Lead Semipaste,	:	:
Containing Volatile Thinner (TT-W-251a)	:100 Pounds	:100 Pounds
Turpentine (LLL-P-791a)	:1 $\frac{1}{2}$ Gallons	:1 $\frac{1}{2}$ Gallons
Interior Varnish (TT-V-71)	:7/8 Pint	: $\frac{5}{8}$ Gallon
Drier (TT-D-651)	: $\frac{1}{2}$ Pint	: $\frac{1}{2}$ Pint

Note: The brushing properties of these comparison paints are somewhat better and the texture and appearance are somewhat inferior to the high grade interior eggshell flat paint desired under the specification.

Interior, Gloss Enamel; Light Tints and White

Federal Specification, TT-P-506 "Enamel; Interior, Gloss, Light Tints and White", covers white and light tint gloss enamels suitable for interior use and not intended for outside exposure. In purchasing tints it is advisable to agree upon a standard sample.

Characteristics: This is an enamel paint, having a varnish-like vehicle which dries with an excellent gloss, not weighing so much nor hiding quite so well as the interior flat eggshell oil paint called for under Federal Specification TT-P-51. It does, however, provide a film that is more resistant to moisture and withstands washing better.

Use: This enamel paint is frequently known as mill white, and while less expensive than the highest grades of zinc oxide enamels, it may generally be used with entire success as an interior enamel paint with a glossy finish. It is applied as a top coat over undercoats of flat or eggshell wall paints. Various degrees of gloss, such as eggshell, etc., may be obtained by mixing interior flat oil paints and interior gloss enamels.

PAINT MIXING FORMULAS USING FEDERAL SPECIFICATION EXECUTIVE COMMITTEE SEMI-PASTE PAINTS

PURPOSE	FORMULA NUMBER	SEMI-PASTE PAINT	RAW LINSEED OIL (JJ-0-336) A		TURPENTINE A (LLL-T-791A)		DRIER (TT-D-651) A	OTHER INGREDIENTS	APPROXIMATE YIELD
			TYPE B	LBS.	GALLONS	GALLONS			
PRIMING COATS WOOD NEW WORK	17	A	100	1 1/4 TO 2	2 1/2 TO 3	3	TO 4	9	TO 10 1/2
	22	B	100	1 1/4 TO 2 1/2	2 1/2 TO 3	3	TO 4	10	TO 12
	27	C	100	1 1/4 TO 2 1/2	2 1/2 TO 3	4	TO 6	14	TO 16 1/4
	31	D	100	3/4 TO 2 1/2	2 1/2 TO 3	3	TO 5	10	TO 11 1/2
	35	E	100	1 1/2 TO 2	2 1/2 TO 3	3	TO 4	9	TO 11 1/4
BODY COATS WOOD OUTSIDE NEW	18	A	100	1 1/2 TO 2	2 TO 3	4	TO 6	7 1/2	TO 8 1/2
	23	B	100	1 1/4 TO 2 1/4	2 1/2 TO 3	5	TO 6	9	TO 10 1/4
	28	C	100	1 1/4 TO 2 1/4	2 1/2 TO 3	4	TO 6	14	TO 14 3/4
	32	D	100	1 1/4 TO 2 1/4	2 1/2 TO 3	5	TO 6	9	TO 10
	36	E	100	1 1/2 TO 2	2 1/2 TO 3	4	TO 6	8 1/4	TO 9 1/4
FINISH COATS OUTSIDE	19	A	100	1 1/2 TO 2	1 1/4 TO 1 1/2	2	TO 2 1/2	7	TO 8
	20	A	100	1 1/4 TO 2 1/4	1 1/4 TO 1 1/2	5	TO 6	10	TO 10 1/4
	24	B	100	1 1/4 TO 2 1/4	2 1/2 TO 3	4	TO 6	9	TO 10 1/4
	25	B	100	4 1/2 TO 7	2 1/2 TO 3	4	TO 6	11	TO 12 1/2
	29	C	100	2 3/4 TO 4 1/2	3/8 TO 1/2	3 1/2	TO 4 1/2	16	TO 19 3/4
	30	C	100	2 3/4 TO 4 1/2	3/8 TO 1/2	3	TO 4 1/2	16	TO 19
	33	D	100	1 1/4 TO 2	1 1/4 TO 1 1/2	4	TO 6	12	TO 15 1/2
	34	D	100	1 1/4 TO 2	1 1/4 TO 1 1/2	4	TO 6	11	TO 13
37	E	100	1 1/4 TO 2	1 1/4 TO 1 1/2	4	TO 6	7	TO 7 3/4	
38	E	100	1 1/4 TO 2	1 1/4 TO 1 1/2	4	TO 6	10	TO 11 1/4	
FINISH COATS ON FLOORS, DECKS, STAIRS, ETC.	21	A	100	1 1/2 TO 2	1 1/4 TO 1 1/2	2	TO 2 1/2	8	TO 9
	26	B	100	1 1/4 TO 2	1 1/4 TO 1 1/2	5	TO 6	9	TO 11 1/4
	29	E	100	1 1/4 TO 2	1 1/4 TO 1 1/2	4	TO 6	9	TO 10
	39	E	100	1 1/4 TO 2	1 1/4 TO 1 1/2	4	TO 6	9	TO 10

FOOTNOTES ON NEXT PAGE

Paint Mixing Formulas Using Federal Specification Executive
Committee Semipaste Paints

^a Federal Specification Number

^b Type of Semipaste Paint

- A. Semipaste White and Tinted (TT-P-36). 100 pounds will occupy about 5 gallons.
- B. Semipaste Iron Oxide (TT-P-31). 100 pounds will occupy about 6 gallons. It should weigh at least $13\frac{1}{2}$ pounds per gallon, but not likely to weigh more than $17\frac{1}{2}$ pounds per gallon.
- C. Semipaste Black (TT-P-61). 100 pounds will occupy about 9 gallons. It must weigh at least 10 pounds per gallon, generally weighs $11\frac{1}{2}$ pounds per gallon.
- D. Semipaste Green (TT-P-71). 100 pounds will occupy about 6 gallons.
- E. Semipaste Olive Drab (TT-P-81). 100 pounds will occupy about $5\frac{1}{2}$ gallons.

^c Volatile Mineral Spirits (TT-P-291) may be substituted for turpentine in this formula.

^d Water-Resisting Spar Varnish (TT-V-121a) is recommended. Interior Varnish (TT-V-71) may be used for interior work. It is better to add varnish to the paint just before using. Addition of varnish to the paint serves to harden the coat and provide a wear-resisting surface.

Note: In nearly all of the above formulas, except for priming coats on new wood, a mixture of $\frac{1}{3}$ to $\frac{1}{2}$ boiled linseed oil and the remainder raw linseed oil may be substituted for the raw oil, omitting the drier.

Conclusions

Cost and Durability:

Dark-colored paints are less expensive and more durable than white or light-colored paints.

Iron Oxide Linseed Oil paint meeting Federal Specification TT-P-31 will last much longer than any white linseed oil paint.

Tinted paints are more durable than the basic white paint untinted. Cream, ivory and tan tints are more durable than sky blue. White or light-tinted paints must contain expensive white pigments to be satisfactory.

White Lead versus Ready-Mixed White Paint: When painting is done by a skilled painter or under skilled supervision; the straight white lead linseed oil paint, generally mixed on the job, is more "fool proof" and safer to use, as painters generally know more about handling white lead paint than they do about mixed paints. In mixing white linseed oil paints, the amounts of oil given in the formulas on page 6 of TIRM - 33 should never be exceeded. Better results will be had by using the lower limits in the amount of oil.

Lead-Zinc paint meeting Federal Specification TT-P-36 will probably be as good as, and in some respects may be more desirable than, straight white lead paint, particularly for tinted paints.

Titanium-Zinc Paint: A properly made, mixed white paint with a pigment approximating 7 percent titanium oxide, 58 percent white lead, 25 percent zinc oxide and 10 percent extender should give excellent service.

Seashore or Marine Exposures: It is frequently advisable, particularly at the seashore to add from one pint to one quart of water-resisting spar varnish to each gallon of paint just before it is applied. It is not advisable to add varnish to paints for undercoat work.

Quick-Drying House Paint: The purpose of such paints is to obtain a quicker drying product than the regular linseed oil type and one that holds its luster and color better than the usual house paint. They frequently contain synthetic resins and high-strength opaque white pigments, such as titanium pigments. For solid colors, pure, high strength pigments are preferred. Others contain high-hiding white pigments (with substantial amounts of white lead), in a vehicle, the drying oils of which are a blend of about 80-90 percent linseed and 10-20 percent tung (Chinewood) oils. A part of the oil is added in a thickened form.