

TT-S-708a
APRIL 27, 1962
SUPERSEDING
INT. Fed. Spec. TT-S-00708 (ARG-FS)
August 15, 1960

FEDERAL SPECIFICATION

STAIN, OIL; SEMI-TRANSPARENT, WOOD, EXTERIOR

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers one grade, one type, and three colors of semi-transparent oil stain for exterior wood. The stain produces an appearance that approximates that of western red cedar or redwood with a durable, lusterless, penetrating finish that leaves the grain pattern and texture of the wood distinctly observable. The stain has become known as the Forest Products Laboratory (FPL) Natural Wood Finish.

1.2 Classification.

1.2.1 Colors. Stain covered by this specification shall be of the following colors:

Cedar color
Light redwood color
Dark redwood color

2. APPLICABLE SPECIFICATIONS, STANDARDS, AND OTHER PUBLICATIONS

2.1 Specifications and standards. The following specifications and standards, of the issues in effect on date of invitation for bids, form a part of this specification:

Federal Specifications:

RR-S-366--Sieves; Standard, Testing.
TT-L-190--Linseed Oil; Boiled (for use in Organic Coatings).
TT-P-143--Paint, Varnish, Lacquer and Related Materials; General Specification for Packaging, Packing and Marking.
TT-P-375--Pigment, Indian Red and Bright Red (Iron Oxide), Dry (for use in Protective Coatings).
TT-P-381--Pigments-in-Oil, Tinting Color.
TT-P-435--Pigment, Sienna, Raw and Burnt, Dry.
TT-P-455--Pigment, Umber, Raw and Burnt, Dry.
TT-T-291--Thinner; Paint, Volatile Mineral Spirits (Petroleum Spirits).
TT-W-570--Wood Preservative, Pentachlorophenol, Solid.
VV-W-95--Wax, Paraffin, Technical.

Federal Standards:

Fed. Std. No. 102--Preservation, Packaging and Packing Levels
Fed. Test Method Std. No. 141--Paint, Varnish, Lacquer, and Related Materials; Methods of Inspection, Sampling and Testing

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications, Standards, and Handbooks and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office,

Washington 25, D. C.

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(Single copies of this specification and other product specifications required by activities outside the Federal Government for bidding purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Washington, D. C., Atlanta, Chicago, Kansas City, Mo., Dallas, Denver, San Francisco, and Auburn, Wash.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications, Standards, and Handbooks from established distribution points in their agencies.)

2.2 Other publications. The following publications, of the issues in effect on date of invitation for bids, form a part of this specification:

Commercial Standard:

CS No. 194-53--Pentachlorophenol Concentrate for Wood Preservation and Soil Poisoning

(Copies required in connection with procurement functions may be obtained from the Superintendent of Documents U. S. Government Printing Office, Washington 25. D. C. Price may be obtained from the Superintendent of Documents.)

American Wood Preservers' Association (AWPA):

Specification A5-Methods for Analysis of Oil-Borne Preservatives

(Application for copies should be addressed to the American Wood-Preservers' Association, 839 Seventeenth Street, NW., Washington 6, D. C.)

3. REQUIREMENTS

3.1 General requirements. The stain shall be supplied in ready-mixed form. The stain shall be well mixed, shall remain in good condition under normal conditions of storage, and shall be easily stirred with a paddle to a uniform condition of good brushing consistency.

3.1.1 Color and appearance. The stain shall match in color and appearance a stain mixed in accordance with the applicable formula in table IV (paragraph 6.4) for the specified color. The color match shall be determined by applying the two stains on adjacent parts of a piece of bare wood.

3.1.2 Drying time. The stain shall dry primarily by absorption in the wood surface. Forty-eight hours after applying the stain to wood, a clean white cotton cloth wiped over the stained surface with light pressure shall pick up no more than a trace of color.

3.2 Detail requirements.

3.2.1 Pigment. The pigment shall consist of one or more of the following, in proportions required to produce the color specified:

Burnt sienna conforming to TT-P-435

Raw umber conforming to TT-P-455

Indian red (iron oxide) conforming to TT-P-375

3.2.1.1 Iron oxide in pigment. The pigment shall contain iron oxide ($\text{Fe}_{27}\text{O}_{37}$) in a proportion that shall not be less than:

38.0 percent by weight in stain of cedar color

39.5 percent by weight in stain of light redwood color

76.0 percent by weight in stain of dark redwood color

3.2.2 Vehicle (liquid). The vehicle shall conform to the requirements of table I.

TABLE I.--Vehicle composition

Ingredients	For cedar or light redwood color		For dark redwood color	
	Percent by weight		Percent by weight	
	Minimum	Maximum	Minimum	Maximum
Linseed oil.....	66.0	.....	64.5	.....
Paraffin wax.....	2.6	3.0	2.6	3.0
Pentachlorophenol.....	5.0	.....	5.0	.....
Volatile thinner.....	.....	26.4	.....	27.9
Suspending agents or other additives.....	.....	.5	.....	.5

3.2.2.1 Linseed oil. At least 90 percent by weight of the linseed oil shall be boiled linseed oil conforming to TT-L-190. The remaining 10 percent of the linseed oil may be raw linseed oil or boiled linseed oil used for grinding the pigments and for control of the consistency of the pigment pastes.

3.2.2.2 Paraffin wax. The paraffin wax shall conform to VV-W-95.

3.2.2.3 Pentachlorophenol. The pentachlorophenol shall conform to TT-W-570.

3.2.2.4 Volatile thinner. At least 85 percent by weight of the volatile thinner shall be mineral spirits conforming to TT-T-291, grade 1. The remaining 15 percent of the volatile thinner may consist of volatile liquids of greater solvent power as may be needed to keep the pentachlorophenol and paraffin wax in solution.

3.2.3 Stain, quantitative requirements. The ready-mixed stain shall meet the requirements specified in table II.

TABLE II.--Quantitative requirements of stain

Characteristics	For cedar or light redwood color		For dark redwood color	
	Minimum	Maximum	Minimum	Maximum
Weight of 1 gallon stain, pounds.....	7.9	.....	7.8	.....
Pigment, percent by weight of stain.....	4.6	.....	3.6	.....
Water, percent by weight of stain.....	.....	1.0	.....	1.0
Nonvolatile vehicle, percent by weight of vehicle.....	73.6	.....	72.1	.....
Acid number of nonvolatile vehicle.....	14.2	.....	14.3	.....
Saponification number of nonvolatile vehicle.....	182.6	.....	182.4	.....
Saponification number of nonvolatile vehicle minus acid number of nonvolatile vehicle.....	168.4	.....	168.1	.....
Coarse particles and skins (residue retained on No. 325 standard sieve[1] percent by weight of pigment).....	.....	2.0	.....	2.0
Absorption, inch.....	.5	.....	.5	.....

[1] Conforming to RR-S-366.

3.2.4 Stain, qualitative requirements.

3.2.4.1 Working properties. When applied by brushing on wood, the stain of this specification shall spread easily, shall permit lapping without difficulty for a minimum of 5 minutes, and shall dry to a uniform appearance without streaking or mottling. The stain shall be absorbed in the wood surface, shall dry without gloss or glossy patches, and shall leave the grain pattern and texture of the wood distinctly observable.

4. SAMPLING, INSPECTION, AND TEST PROCEDURES

4.1 Unless otherwise specified herein, the supplier is responsible for

the performance of all inspection requirements prior to submission for inspection and acceptance. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to purchaser. Inspection records of the examinations and tests shall be kept complete and available to the purchaser as specified in the contract or order.

4.2 Sampling and inspection should be in accordance with methods 1011, 1021 and/or 1031 of Fed. Test Method Std. No. 141, as applicable.

4.3 Test procedures.

4.3.1 The following tests shall be conducted in accordance with Fed. Test Method Std. No. 141, as indicated in table III, except that

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the tests for acid number and saponification number of the nonvolatile vehicle shall be modified as required by 4.4 of this specification.

TABLE III.--Sampling and tests

Item	Sampling and tests	Fed. Test Method Std.No.141, method No.	Section of this specification giving further details	Section of this specification giving requirements
1	Sampling.....	1021	.....	.....
2	Weight per gallon.....	4184	.....	Table II
3	Pigment content.....	4021	.....	Table II
4	Analysis of pigment.....	7291	.....	3.2.1.1
4a	Iron oxide.....	7141	.....	3.2.1.1
		(3.2.1)	.....	3.2.1.1
5	Water.....	4081	.....	Table II
6	Volatile and nonvolatile content.....	4041	.....	Table II
7	Vehicle solids.....	4051	.....	Tables I, II
8	Vehicle isolation.....	4032	.....	.....
9	Acid number of nonvolatile vehicle.....	5071	4.3	Table II
10	Saponification number of nonvolatile vehicle.....	5081	4.3	Table II
11	Coarse particles and skins....	4091	.....	Table II
12	Condition in container.....	3011	.....	3.1
13	Absorption.....	4421	.....	Table II

4.4 Modification of methods for acid number and saponification number. Acid number and saponification number shall be determined in the total vehicle as isolated by method 4032 of Fed. Test Method Std. No. 141. The acid number of the nonvolatile vehicle is obtained by dividing the acid number of the total vehicle by the fraction of nonvolatile vehicle in the total vehicle. Similarly the saponification number of the nonvolatile vehicle is obtained by dividing the saponification number of the total vehicle by the fraction of nonvolatile vehicle in the total vehicle. (This procedure is necessary because evaporation of the total vehicle on a steam bath, to isolate the nonvolatile vehicle before determining acid number and saponification number leads to erroneous results.)

4.5 Additional tests.

4.5.1 Working properties and appearance after application. The stain shall be tested for working properties and appearance on panels of ponderosa pine conforming to Fed. Test Method Std. No. 141, method 2031. For each sample of stain to be tested a panel not less than 200 square inches in area shall be provided. Application of stain shall conform to method 2141 of Fed. Test Method Std. No. 141, and shall be at a spreading rate of approximately 550 square feet per gallon. On one-half of the panel apply stain mixed according to the formula in 6.4 for the color specified. Observe whether the stain to be tested brushes easily and permits lapping without difficulty for at least 5 minutes. Let stand 48 hours. The sample to be tested shall match the comparison standard of 6.4 in color, absence of gloss or glossy patches, and degree of visibility of the grain pattern and texture of the wood. Wipe the surface stained with the sample to be tested with a clean, white, cotton cloth. The cloth shall not pick up more than a trace of color from the

stained wood surface.

4.5.2 Paraffin wax in vehicle. Isolate the vehicle from a sample of the stain by method 4032 of Fed. Test Method Std. No. 141. (Reserve part of the isolated vehicle for the test described in 4.5.3.) Saponify a 4- to 5-gram sample with 25 milliliters of alcoholic potassium

hydroxide solution according to the first part of the procedure of method 5081 of Fed. Test Method Std. No. 141. Cool the saponified sample to a temperature not exceeding 25 deg. C. and add 50 milliliters of distilled water. Shake thoroughly. Filter, extract the paraffin wax, and weigh in accordance with method 5231 of Fed. Test Method Std. No. 141. Calculate the percentage of paraffin wax in the vehicle of the stain by the following equation:

$$\text{Percent of paraffin wax} = \frac{W}{S} \times 100$$

in which W = grams of paraffin wax obtained

S = grams of sample taken.

4.5.3 Pentachlorophenol in vehicle. With the remaining part of the vehicle from 4.5.2, determine the content of pentachlorophenol by the method of American Wood Preservers' Association Specification A5.

5. PREPARATION FOR DELIVERY

(For civil agency procurement the definitions and applications of the levels of packaging and packing shall be in accordance with Fed. Std. No. 102.)

5.1 Packaging, packing, and marking. The stain shall be packaged, packed, and the containers marked in accordance with TT-P-143. The level of packaging shall be A, B, or C, and the level of packing shall be A, B, or C as specified (see 6.2). The stain shall be furnished in 1-pint, 1-quart or 1-gallon multiple friction top containers, in 5-gallon lug cover steel pails or in 55-gallon steel drums.

5.2 Special marking. The following statement shall be shown on the front side of the containers:

"CAUTION"
 May cause skin irritation
 avoid prolonged or repeated contact with skin
 Avoid prolonged breathing of vapor
 Use only with adequate ventilation

6. NOTES

6.1 Intended use. This stain is intended for use on exterior wood, either smoothly planed or roughly surfaced, where it is desired to permit the grain and texture of the wood surface to be seen more clearly than is possible with more highly pigmented stains such as TT-S-706, and where it is not necessary to provide the high degree of protection against wood weathering and retardation of dimensional changes obtainable with multiple coats of oil paint. House siding, fencing, and roadside signboards typify the intended use. On the other hand, this stain is not considered satisfactory for such millwork as frames, windows, and doors which need a high degree of protection against dimensional changes. It should not be used on surfaces that may soon be painted because the paraffin wax in the stain interferes with the drying and durability of the paint unless the stained surface has weathered for one or two years before paint is applied. This stain cannot be applied successfully to previously painted or varnished surfaces unless all previous coating has been removed to expose bare wood for staining.

6.2 Directions for use. On new, smoothly surfaced wood apply one coat only of the stain at a spreading rate of approximately 550-square-feet-per-gallon. More stain will be consumed on rough wood surfaces according to the degree of roughness. Ordinarily at least three years should elapse before further application of stain becomes necessary. For refinishing after a previous application has worn out, the stain may be thinned with not more than 1 quart of mineral spirits per gallon of stain. If more than one coat of stain is applied at a time the last coat may dry with glossy patches and give a painted appearance.

6.3 Ordering data. Stain should be purchased by volume (231 cubic inches to the gallon). Purchasers should specify kind of packaging container required, should specify the color desired, and should exercise any desired option offered herein. (See 5.1, 5.2, 5.3.1, and 6.5).

6.4 Formulas for mixing suitable stains from available ingredients.
Stains conforming

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to this specification can be mixed from ingredients available under Federal specifications or commercial standards. The mixtures shall be made according to the following formulas:

TABLE IV. Formulas for mixing stains from available ingredients

Ingredients to make slightly less than 5 gallons of stain	Quality of ingredient for		
	Cedar color	Light redwood color	Dark redwood color
Paraffin wax, VV-W-95, type I, grade C...	1.0 lb.	1.0 lb.	1.0 lb.
Zinc stearate.....	.125 lb.	.125 lb.	.125 lb.
Mineral spirits, TT-T-291, grade 1.....	1.0 gal.	1.0 gal.	1.125 gal.
Pentachlorophenol concentrate, Com. Std No. 194-53.....	.5 gal.	.5 gal.	.5 gal.
Boiled linseed oil, Fed. Spec. TT-L-190..	3.0 gal.	3.0 gal.	3.0 gal.
Burnt sienna in oil, Fed. Spec. TT-P-381, color 3B.....	1.0 pt.	1.0 qt.	.333 pt.
Raw umber in oil, Fed. Spec. TT-P-381, color 3D.....	1.0 pt.	none	.333 pt.
Indian red iron oxide in oil, Fed. Spec.. TT-P381, color 6B.....	none	none	.667 pt.

Melt the paraffin wax and the zinc stearate together in a container heated by a steam or hot water jacket or coils; pour the molten mixture into the mineral spirits with vigorous stirring. When the solution has cooled, add the pentachlorophenol concentrate and the boiled linseed oil. Finally add the required colors in oil slowly and with vigorous stirring. (Since mineral spirits evolves flammable vapors and paraffin and linseed oil will burn, do the mixing in a well ventilated place where there is no open flame or other source of ignition.)

6.5 Other colors. If one of the three colors specified herein is satisfactory, it is believed that this specification adequately described the characteristics necessary to secure the desired material and that normally no samples will be necessary prior to award to determine compliance with this specification. It is possible, however, to vary the color within certain limits by altering the proportions of burnt sienna, raw umber, and red iron oxide in the total pigment. If such variation in color is desired, the purchaser should ask for suitable samples to be submitted with bids as a basis for agreement on the color desired. This specification does not cover stains made with pigments other than burnt sienna, raw umber, and Indian red iron oxide.

6.6 Transportation description. Transportation descriptions and minimum weights applicable to this commodity are:

Rail:

Stains, not otherwise indexed by name, liquid.
Carload minimum weight 36,000 pounds

Motor:

Stains, not otherwise indexed, liquid.
Truckload minimum weight (W) 36.6 pounds, (W) subject to Rule 34,
National Motor Freight Classification.

Notice. When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise, as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Copies of this specification may be purchased for 5 cents each.

TT-S-708A
AMENDMENT-2
June 23, 1977
SUPERSEDING
Amendment-1
November 6, 1972

FEDERAL SPECIFICATION

STAIN, OIL: SEMI-TRANSPARENT, WOOD, EXTERIOR

This amendment, which forms a part of Federal specification TT-S-708A, dated April 27, 1962, was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

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Under Federal Specifications:

Change "TT-P-143" to "PPP-P-1892".

Delete "TT-P-435 - Pigment, Sienna, Raw and Burnt, Dry" and "TT-P-455 = Pigment, Umber, Raw and Burnt, Dry".

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Under "2.2 other publications" add:

- "D 50 - Chemical Analysis of Yellow, Orange, Red and Brown Pigments Containing Iron and Manganese.
- D 185 - Test for Coarse Particles in Pigments, Pastes and Paints.
- D 355 - Specification for Wood to be Used as Panels in Weathering Tests of Paints and Varnishes.
- D 763 - Specification for Raw and Burnt Umber.
- D 765 - Specification for Raw and Burnt Sienna.
- D 1475 - Test for Density of Paint, Varnish, Lacquer and Related Products.
- D 1639 - Test for Acid Value of Organic Coating Materials.
- D 1692 - Test for Saponification Value of Drying Oils, Fatty Acids and Polymerized Fatty Acids.
- D 2369 - Test for Volatile Content of Paints.
- D 2698 - Determination of Pigment Content of Solvent-Type Paints by High Speed Centrifuging."

Paragraph 3.2.1, line 4. Delete "TT-P-435" and substitute "ASTM D 765", line 5. delete "TT-P-455" and substitute "ASTM D 763".

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Paragraph 3.2.2.4, lines 3 and 4. Change "TT-T-291, grade I" to "TT-T-291, type II, grade A". Add to the paragraph the following: "This remaining 15 percent of volatile thinner shall comply to Rule 66." [1]

Table II. At end of table, add, under characteristics, Lead, percent nonvolatile", under both minimum columns, "---", under both maximum columns, "0.06".

Paragraph 4.3.1. Delete and substitute:

"4.3.1 The stain shall be tested as indicated in table III and as

specified hereinafter."

[1] Information on Rule 66 should be obtained from Air Pollution Control District, Los Angeles, California 90013.

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Table III. Delete and substitute:

TABLE III. Sampling and tests

Item	Sampling and Tests	Fed. Test Method Std. No. 141	ASTM Method	Section of this specification giving requirements
1	Sampling	1021	----	----
2	Weight per gallon	---	D 1475	Table II
3	Pigment content	4021	----	Table II
4	Analysis of pigment	7291	----	3.2.1.1
4a	Iron oxide	--	D 50	3.2.1.1
5	Water	4081	----	Table II
6	Volatile and nonvolatile content	----	D 2369	Table II
7	Vehicle solids	4051	----	Tables I, II
8	Vehicle isolation	----	D 2698	----
9	Acid number of nonvolatile vehicle[1]	----	D 1639	Table II
10	Saponification number of nonvolatile vehicle[1]	----	D 1962	Table II
11	Coarse particles and skins	----	D 185, Sec 6	Table II
12	Condition in container	3011	----	3.1
13	Absorption	4421	----	Table II

[1] See 4.4 for modification of test.

Paragraph 4.4, line 5. Delete "Method 4032 of Fed. Test Method Std. No. 141" and substitute "ASTM Method D 2698".

Paragraph 4.5.1, lines 4 and 5. Delete "Fed. Test Method Std. No. 141, Method 2031", and substitute "ASTM Method D 358".

Paragraph 4.5.2, lines 2 and 3. Delete "Method 4032, of Fed. Test Method Std. No. 141" and substitute "ASTM Method D 2698".

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Paragraph 4.5.2, line 2. Delete "Method 5081 of Fed. Test Method Std. No. 141", and substitute "ASTM Method D 1962".

Add new paragraphs:

4.5.4 Lead content.

4.5.4.1 Sample preparation. Using a 0.006-inch film applicator and a mechanical applicator plate, duplicate drawdowns for each sample of well-mixed paint shall be made on a standard penetration chart and dried for 24 hours. The drawdown shall be at least 10 inches long on the sealed portion of the penetration chart. The drawdown shall be cut into discs of appropriate size to fit the sample holder of a fluorescence X-ray spectrometer.

4.5.4.2 Procedure. Lead content shall be determined using an X-ray fluorescence spectrometer capable of determining lead content at a minimum level of 0.03 percent by weight of the total nonvolatile. The settings for a wavelength dispersive fluorescence spectrometer shall be as follows: [1]

Analytical

X-ray tube

<u>Element</u>	<u>line</u>	<u>Angle</u>	<u>Crystal</u>	<u>Detection</u>	<u>Collimeter</u>	<u>(MO)</u>
Pb	L	33.93	LiF(200)	Flow S.C.	Fine	60Kv 45Ma
Pb (backgrd I)		33.00	LiF(200)	Flow S.C.	Fine	60Kv 45Ma
Pb (backgrd II)		35.50	LiF(200)	Flow S.C.	Fine	60Kv 45Ma
Mo	K	20.33	LiF(200)	Flow S.C.	Fine	60Kv 45Ma

[1] Energy dispersive fluorescence spectrometers shall be set up according to the manufacturer's manual.

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Pulse height selection shall be used in all measurements and counting time shall be 100 seconds. Place the sample disc in the wavelength dispersive unit. Measure the count rates of lead, lead background, and the Molybdenum Compton scattered background from the X-ray tube.

4.5.4.3 Calculation.

$$R = \frac{I_{\text{Pb}} - I_{\text{Pb}} (\text{Background I}) + I_{\text{Pb}} (\text{Background II})}{2 I_{\text{Mo}}}$$

where I equals gross intensity. These results shall be compared to those obtained with a 0.06 percent lead standard made up from the same type of paint sample and evaluated for compliance with table I.

Paragraph 5.1, line 3. Delete "TT-P-143" and substitute "PPP-P-1892".