

DEPARTMENT OF COMMERCE

BUREAU OF STANDARDS

S. W. STRATTON, Director

CIRCULAR OF THE BUREAU OF STANDARDS

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RECOMMENDED SPECIFICATION FOR SPAR VARNISH

PREPARED AND RECOMMENDED BY THE U. S. INTERDEPARTMENTAL COMMITTEE ON PAINT SPECIFICATION STANDARDIZATION, SEPTEMBER 27, 1920; P. H. WALKER, BUREAU OF STANDARDS, CHAIRMAN; J. W. GINDER, TREASURY DEPARTMENT, SECRETARY.

This committee was appointed at the suggestion of the Secretary of Commerce, and consisted of representatives of the War, Navy, Agriculture, Interior, Post Office, Treasury, and Commerce Departments, the Panama Canal, and the Educational Bureau of the Paint Manufacturers' Association of the United States. The committee submitted a preliminary draft of the specification to a large number of representatives of the paint and varnish manufacturers, and gave careful consideration to the replies received.

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1. GENERAL

The varnish shall be the best long oil varnish. It must be resistant to air, light, and water. The manufacturer is given wide latitude in the selection of raw materials and processes of manufacture, so that he may produce a varnish of the highest quality. It must meet the following requirements:

APPEARANCE.—Clear and transparent.

COLOR.—Not darker than a solution of 6 g of potassium dichromate in 100 cc of pure sulphuric acid, specific gravity 1.84.

FLASH POINT (CLOSED-CUP).—Not below 30° C (85° F).

NONVOLATILE MATTER.—Not less than 40 per cent by weight.

SET TO TOUCH.—In not more than 5 hours.

DRY HARD AND TOUGH.—In not more than 24 hours.

TOUGHNESS.—Film on metal must stand rapid bending over a rod 3 mm ($\frac{1}{8}$ inch) in diameter.

WORKING PROPERTIES.—Varnish must have good brushing, flowing, covering, and leveling properties.

WATER RESISTANCE.—Dried film must withstand cold water for 18 hours and boiling water for 20 minutes without whitening or dulling.

DURABILITY.—The purchaser reserves the right to require that the durability of deliveries must be equal to a brand or sample mutually agreed upon by buyer and seller.

NOTE.—When durability tests are required, such tests will be made on each sample; but in cases where the testing laboratory has previous data on the same brand of varnish, acceptance or rejection of a given sample may be provisionally based on the last completed test of the brand of varnish in question.

2. SAMPLING

It is mutually agreed by buyer and seller that a single package out of each lot of not more than 1000 packages be taken as representative of the whole. Whenever possible, an original unopened container shall be sent to the laboratory, and when for any reason this is not done, the inspector shall thoroughly mix the contents of the container sampled, transfer not less than 1 quart to a clean, dry glass bottle or tin can which must be nearly filled with the sample, securely stoppered with a new clean cork or well-fitting cover or cap, sealed, and distinctly labeled by the inspector.

The inspector should take a duplicate from the container sampled to be held for check in case of dispute, and, when requested, should take a sample for the seller.

3. LABORATORY EXAMINATION

Samples will in general be tested by the following methods, but the purchaser reserves the right to apply any additional tests or use any available information to ascertain whether the material meets the specification.

(a) **APPEARANCE.**—Pour some of the thoroughly mixed sample into a clear glass bottle or test tube and examine by transmitted light. The varnish must be clear and transparent.

(b) **COLOR.**—Prepare a standard color solution by dissolving 6 g of pure powdered potassium dichromate in 100 cc of pure concentrated sulphuric acid of specific gravity 1.84. Gentle heat

may be used if necessary to perfect the solution of the dichromate. The standard color solution and a sample of the varnish to be tested shall be placed in clear thin-walled glass tubes of the same diameter. The color comparison shall be made by placing the tubes close together and looking through them by transmitted light. The tubes used for this test should be 1.5 to 2.0 cm ($\frac{5}{8}$ to $\frac{13}{16}$ inch) in diameter and shall be filled to a depth of at least 2.5 cm (1 inch). (Since the potassium dichromate-sulphuric acid must be freshly made for this color comparison, it is frequently more convenient to compare samples with a permanently sealed tube of varnish which has previously been found to be slightly lighter in color than the standard solution of 6 g dichromate in sulphuric acid. When samples are found to be darker than this standard tube of varnish, the dichromate standard should be made up for final decision).

(c) FLASH POINT.—Determine with either the "Tag" or Elliott closed-cup tester. The former is preferred, and directions for its use are found in A. S. T. M. Standards D 56-19. For method of determining with the Elliott cup see Proceedings A. S. T. M., 1917, part I, p. 414.

(d) NONVOLATILE MATTER.—Place a portion of the sample in a stoppered bottle or weighing pipette. Weigh container and sample. Transfer about 1.5 g of the sample to a weighed flat-bottomed metal dish about 8 cm in diameter (a friction-top can plug). Weigh container again and by difference calculate the exact weight of the portion of sample transferred to the weighed dish. Heat dish and contents in an oven maintained at 105 to 110° C (221 to 230° F.) for three hours. Cool and weigh. From the weight of the residue left in the dish and weight of the sample taken, calculate the percentage of nonvolatile residue.

(e) DRYING TIME.—Pour the varnish on a clean glass plate not less than 15 cm (6 inches) long and 10 cm (4 inches) wide. Place the plate in a nearly vertical position in a well-ventilated room but not in the direct rays of the sun. The atmosphere of this room must be free from products of combustion or laboratory fumes. The temperature of the room should be from 21 to 32° C (70 to 90° F.). The film is tested at points not less than 2.5 cm (1 inch) from the edges of the film by touching lightly with the finger. The varnish is considered to have set to touch when gentle pressure of the finger shows a tacky condition but none of the varnish adheres to the finger. The varnish is considered to have

dried hard when the pressure that can be exerted between the thumb and finger does not move the film or leave a mark which remains noticeable after the spot is lightly polished. If rapid light rubbing breaks the surface, the sample is considered not to have satisfactorily dried hard. In case the test shows time of setting to touch or drying hard more than 5 and 24 hours respectively, a second test shall be run on a different day and the average of the two tests taken.

(f) TOUGHNESS.—Thoroughly clean with benzol a sheet of bright tin 10 by 15 cm (about 4 by 6 inches). This bright tin should be approximately 0.3 to 0.4 mm (0.0125 to 0.0158 inch) thick (90 to 100 pounds weight of base metal per standard box of 112 sheets, 14 by 20 inches, Nos. 30 to 28 U. S. standard plate gage). Flow the varnish on one side of the tin plate and let it dry in a vertical position in a well-ventilated room, not in the direct rays of the sun, at a temperature not below 21° C (70° F) for a period of not less than 6 days, then bring to a temperature between 21 and 24° C. (70 to 75° F.) and with the varnish film on the outside, bend rapidly over a rod 3 mm ($\frac{1}{8}$ inch) in diameter. The film must show no evidence of cracking or flaking.

(g) WORKING PROPERTIES AND WATER RESISTANCE.—The panels on which these tests are made shall be of basswood, filled with one coat of drop black in oil thinned with turpentine and drier, and allowed to dry for not less than 10 days before applying the varnish. The varnish shall be applied by brushing and must work easily under the brush. One coat of varnish shall be allowed to dry in a horizontal position, not in the direct rays of the sun, in a well-ventilated room for not less than 48 hours. The panel shall then be lightly sandpapered with No. 00 sandpaper and given a second coat, which should dry in the same way for not less than 72 hours. The completed panel must be smooth, glossy, and free from brush marks or other defects. The panel shall then be inclined at an angle of 45° to the vertical and a gentle stream of tap water allowed to flow for 18 hours down the middle of the varnished surface. After wiping off with a soft cloth or chamois skin any deposit due to tap water, the varnish must show no whitening, dulling, or other visible defect. A small stream of boiling distilled water shall then be allowed to flow down another portion of the panel for 20 minutes. The water shall be siphoned through a small glass tube (about 5 mm bore with delivery end

flattened to an opening about 5 by 1 mm) directly from the container in which it is boiling upon the surface of the panel in such manner that there will be no appreciable lowering of the temperature of the water before it touches the varnish film. The siphon delivery tube shall be in a plane nearly parallel to the plane of the panel so that the impact of the water will not tend to break the film. The varnish shall show no whitening and no more than very slight dulling or other indications of marked deterioration either when observed immediately after removing from the water or after drying for two hours.

(h) DURABILITY.—Durability tests are so much influenced by weather conditions that it is always necessary to make them in comparison with a varnish of known durability. The tests shall be made on unfilled panels of maple wood not less than 14 by 45 by 2 cm ($5\frac{1}{2}$ by 18 by $\frac{3}{4}$ inch). Three coats of varnish shall be applied to each test panel, allowing 3 days for drying each coat. The first coat, after drying indoors for 3 days, shall be lightly sandpapered with No. 00 sandpaper before application of the second coat. The second and third coats shall not be sandpapered or rubbed. The backs and edges of the panels shall be varnished with three coats of the sample, but for these surfaces the details of the method of application as given need not be adhered to, and the effects of exposure on these surfaces shall not be considered. Three days after the application of the third coat the panels shall be exposed outdoors 45° to the vertical facing south. The panels shall be inspected at intervals of not more than 14 days. The varnish being tested shall be considered to have failed if each of the duplicate panels begins to show failure by cracking, flaking, or other defects more than 14 days before similar failure is apparent on the panels of the comparison varnish exposed at the same time.

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