

TECHNICAL INFORMATION ON BUILDING MATERIALS  
FOR USE IN THE DESIGN OF LOW-COST HOUSING

TIBM - 48

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THE NATIONAL BUREAU OF STANDARDS  
UNITED STATES DEPARTMENT OF COMMERCE  
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SHELLAC

This is chiefly a digest of sections of applicable Federal Specifications<sup>1</sup> and National Bureau of Standards publication, Technologic Paper T232 "Shellac", (March 12, 1923),<sup>2</sup> by Percy H. Walker and Lawrence L. Steel, covering basic materials, preparation, grades, orange shellac, bleached shellac, and shellac varnish.

Basic Materials

Lac Resin: Lac or lac resin, the dried assimilated sap excreted by generations of the East Indian insect "Tacchardia Lacca" on the twigs of various species of trees on which they feed and propagate, is the primary basic material from which shellac is produced.

Stick Lac: Lac resin incrustated twigs broken into short pieces are the stick lac of commerce.

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<sup>1</sup>Specifications adopted by the Federal Specifications Executive Committee and approved by the Director of Procurement, Treasury Department, for use of all departments and establishments of the Government. Copies of all Federal Specifications mentioned in this digest may be obtained from the Superintendent of Documents, Washington, D. C. (Price 5 cents)

<sup>2</sup>Available from the Superintendent of Documents, Washington, D. C. (Price 5 cents)

Seed or Grain Lac is stick lac crushed into small granules, about the size of wheat. The granules, ruby-red in color, are washed with water to remove a portion of the dye, and then screened to remove as much of the twigs and bark as possible.

Garnet Lac, a dark colored product, is usually made from the impure lac residue remaining in the cloth bag used in producing flake shellac. Sand and other impurities are usually eliminated by dissolving the impure lac in alcohol or a dilute sodium carbonate solution, and filtering. The alcohol is either driven off or the lac is liberated from the alkaline solution by acid, and then fused into lumps of various sizes. Button lac is essentially shellac fused into a mass the shape of a button.

### Preparation

Shellac is usually made by melting dry seed lac with up to 0.7% arsenic sulphide (orpiment), with or without the addition of small amounts of rosin, in long narrow cloth bags over a charcoal fire. The softened lac mixture squeezed through the cloth by twisting the bag, is resoftened and stretched into thin sheets, which, after cooling, are broken into the familiar shellac flakes of commerce.

### Grades

Grading of shellac is based upon freedom from rosin and dirt, and upon color of the flakes. Rosin is the most common adulterant of shellac, especially because it greatly facilitates the melting of seed lac, and also because of its low price.

### Orange Shellac

Properties: Orange shellac is available both in the dry form (flake, seed, or grain) and in solution in alcohol (shellac varnish). Specific gravity varies from 1.196 to 1.217, owing to minute air bubbles inclosed during the manufacturing process. The softening point is indefinite, and decomposition starts if shellac is heated much above 100°C. It is insoluble in dilute mineral acids, and quite insoluble in petroleum hydrocarbons and turpentine (a property possessed to the same degree by no other common resin soluble in alcohol). It dissolves in ammonia or solutions of sodium carbonate, borax, and other alkalis, and with the exception of a small amount of natural wax and mineral matter; it also dissolves in cold methyl or ethyl

alcohol or in a mixture of these two (denatured alcohol), isopropyl, and amyl alcohols (fusel oil). High-proof alcohol must be used. Ethyl or denatured alcohol much weaker than 95% by volume does not dissolve shellac perfectly. Orange shellac is very stable and does not depreciate in quality even during long storage.

The apparent light color of some samples of orange shellac may be misleading where such effect is caused by air bubbles or the use of orpiment. When the samples are dissolved in alcohol, the orpiment tends to slowly settle; the inclosed air bubbles are released; and the resulting solution may be darker than the solution of a flake shellac containing less inclosed air and orpiment and apparently of a darker shade when in flake form.

Federal Specification: Specification TT-S-271 "Shellac; Orange" covers four types (A,B,C, and D) of orange shellac for use in ship-bottom paints and in the preparation of orange shellac varnish.

Type A, in general, includes the grades of shellac known in the trade as "Double triangle G", "Diamond I", "Superfine", the so-called machine-made shellacs such as "CV" and "CVTN", and the highest grades "D.C." and "V.S.O."

Type B, in general, includes the grades considered in the trade as lower than "superfine", but higher than pure "T.N.", such as "Fine", "Good", and "Heart".

Type C represents the grade known in the trade as "pure T.N." which is rosin-free, but darker and containing more insoluble material than types A or B.

Type D represents the grade known in the trade as "U.S.S.A.T.N." It usually contains up to a maximum of 3% rosin, and, in addition, it contains more insoluble material and is generally darker than types A or B, but is usually a little lighter in color than type C.

Orange shellac, to meet this specification, must be the manufactured product of stick lac freed from most of the lac dye and prepared in flake form. Seed, garnet, and button lac are not permissible.

#### Bleached Shellac

Bleached shellac is produced by dissolving orange shellac in a dilute sodium carbonate solution, and then bleaching the solution with a sodium hypochlorite solution which destroys the red lac dye.

The bleached shellac is then precipitated by mineral acid as an amorphous yellowish-white mass. Bleached shellac (white shellac), prepared by this process, is quite sensitive to heat and must be dried with care at rather low temperatures, or it may become partially or wholly insoluble in alcohol. When stored for a time, bleached shellac tends to become more or less insoluble in alcohol.

### Shellac Varnish

Preparation: Shellac varnish is produced by "cutting" (dissolving) dry orange or bleached shellac in high-proof alcohol. The weighed shellac in dry form should stand overnight in a closed vessel containing the proper volume of 190°-proof alcohol,<sup>1</sup> and then be stirred at intervals until all lumps disappear. Mechanical stirring devices are used for this purpose in factories manufacturing such products.

Properties: The resistance of a dried film of shellac varnish to turpentine and turpentine substitute (mineral spirits) is of great value where the shellac is used as a first coating to fill the pores of wood, and to cover resinous knots and streaks, because any varnish or wax polish subsequently applied does not soften the shellac. This valuable property is not possessed by most commercial so-called shellac substitutes. Shellac varnish is not suitable for outside exposures, as the dried film does not possess the waterproof qualities and resistance to weather of a good long-oil spar varnish.

Shellac varnish dries only through evaporation of the solvent. In humid weather the rapid evaporation of alcohol from the film may lower the temperature sufficiently to cause moisture condensation. This may turn the film white temporarily, but eventually the coating should dry to its normal color.

Federal Specification: Specification TT-V-91 "Varnish; Shellac" is intended to cover all needs of the Government for shellac varnish, which shall be furnished as "Orange", Type I or II, and as "Bleached", Type I or II. Each type shall also be furnished as light, medium, or heavy body as specified. The shellac varnish shall be made by "cutting" the specified type of shellac in 95% specially denatured alcohol, United States Internal Revenue Bureau Formula No. 1.

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<sup>1</sup>While pure 190°-proof alcohol may be used, a special denatured alcohol which consists of 100 gallons of ethyl alcohol 190°-proof and five gallons of approved wood alcohol, is commonly used.

## Orange Shellac Varnish

Type I, in general, includes the rosin-free material and the lighter colored varnishes. Type II is intended for use where the presence of small percentages of rosin (not over 3%) is not objectionable and where lightness of color is not essential.

Bleached Shellac Varnish:<sup>1</sup> Type I, in general, will fulfill all needs for a white shellac varnish. Type II will only be used in cases where a clear bleached varnish, practically free from wax or other suspended matter, is necessary.

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<sup>1</sup>Sometimes called "White shellac varnish".

