

MAKING LOG CABINS ENDURE

SUGGESTIONS ON CONSTRUCTION, LOG SELECTION

PRESERVATION, AND FINISHING

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### NOTICE

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## MAKING LOG CABINS ENDURE

### Suggestions on Construction, Log Selection, Preservation, and Finishing

Forest Products Laboratory,<sup>1</sup> Forest Service  
U.S. Department of Agriculture

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#### Introduction

Today, log cabins are built mostly for summer homes and recreational purposes. In sparsely settled, wooded sections of the country, however, the building of log cabins for year-round homes has not entirely ceased. Whatever the purpose, no one wants to build a log cabin that will begin to deteriorate in a short time. Yet, many log cabins are built in such a way that early decay or insect attack is almost certain, just because the builders overlook certain simple precautions. The prevention of decay and insect attack usually is not difficult, and it seems surprising that so little attention is given to it. Decay organisms and many insects cannot attack dry wood. Therefore, the main principles of preventing deterioration are to use dry wood and keep it dry, or when this is impossible, use naturally resistant or preservative-treated wood.

The purpose of this report is to point out some simple precautions that may be taken to insure long cabin life. For a more complete discussion of log cabin design or details of construction, reference (1)<sup>2</sup> will be helpful.

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<sup>1</sup>Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

<sup>2</sup>Numbers in parentheses refer to Literature Cited at the end of this report.

## Selection and Handling of Logs

### Type of Wood

Considerable variation occurs in the natural decay resistance of heartwood, but not the sapwood, of different tree species. The heartwood of such species as the cedars, redwood, and baldcypress is of the resistant type and will outlast most other woods when used under conditions favoring decay or insect attack. Since the resistance of these woods rests entirely in the heartwood, however, reasonably long life where hazards are high can be expected only from logs having little sapwood. On the other hand, many species such as aspen have little resistance either in the heartwood or sapwood. With all species, the hazard of damage will be less in cold or dry climates than in warm and moist situations. In any case, logs should not be used in contact with the ground unless they are properly treated with preservatives.

### Unpeeled Logs

Logs with the bark left intact are almost impossible to protect from deterioration over long periods of time. The bark slows down drying of the logs to such an extent that some decay in the interior is almost certain before the log becomes fully seasoned. Furthermore, bark encourages the attack of such insects as bark beetles and some wood borers. The beetles loosen the bark to the point where it is likely to fall or be easily knocked off in patches. Nails or wooden pegs sometimes are used in an effort to keep loose bark in place, but even so, it is difficult to keep the bark entirely intact over long periods. The borers that are attracted to wood with bark may cause extensive tunneling in the wood, often accompanied by noises and the appearance of sawdust-like remains as their damage proceeds.

If unpeeled logs are to be used, they should preferably be cut in winter when both insects and decay fungi are least active. The logs should be piled off the ground to promote as much drying as possible. The chances of retaining the bark are improved if insect and decay attack can be prevented until the wood beneath the bark has become relatively dry. After cutting and piling, the logs should be thoroughly treated on all surfaces by spraying or swabbing them with a combination insecticide and fungicide. A solution containing 0.5 percent lindane and 2 to 3 percent of pentachlorophenol in a light oil carrier is one of the most effective treatments<sup>3</sup> In warm weather, the

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<sup>3</sup>See Notice inside front cover.

treatment should be given within a day after cutting the logs, but under winter conditions, such quick treatment is less important. Yearly sprays with the above insecticide-fungicide solution after the logs are in place probably would do enough good to justify cost and, therefore, are worthy of consideration.

Precautionary measures of the type just mentioned represent minimum efforts to avoid damage to unpeeled logs. Among other possible measures is the removal of the bark in large sections at the time the log is cut, and then replacing the bark by nailing or pegging after the outer parts of the peeled logs have dried. The evidence concerning the effectiveness of this procedure is limited. Another alternative is to treat the unpeeled logs with a preservative, such as that discussed later for peeled logs, supplemented possibly by a spray with lindane. Unfortunately, preservative solutions will not penetrate through bark, so most types of treatments mentioned later are not suitable for unpeeled logs. One possibility however, is a treatment by a diffusion process that is carried out either (a) in the standing tree before cutting, (b) immediately after cutting, but while the tops and leaves of the tree are still intact, or (c) immediately after cutting the tree to log lengths. Such applications of preservatives will give varying degrees of protection to the logs, depending on how thoroughly the chemicals will diffuse into and throughout the wood.

### Peeled Logs

Practically all log structures are built of peeled rather than unpeeled wood because of its greater permanence, ease of building and maintenance, and aesthetic effect. The remainder of this report, therefore, presupposes that peeled logs are being used.

Cutting and peeling of the logs should be done, if possible, during the winter season so that some drying can take place before the warm weather. Although logs are usually more difficult to peel in winter than in spring or early summer, the protection that winter peeling affords against fungi and insects more than offsets any extra labor involved in peeling. Regardless of when cutting is done, the peeled logs should be piled off the ground in the open so that the air can circulate freely around each piece. Such open piling is desirable until the logs are fairly well or fully seasoned. By open piling in this way, the hazard of decay occurring in the interior of the logs is less than if the logs are placed in the cabin while still green or only slightly seasoned.

When logs are cut and peeled during warm weather, molds and blue stain fungi may develop rapidly on the surfaces and discolor the logs to an undesirable degree. Although these stains and molds do not damage the logs appreciably, they do spoil the bright, new appearance of the logs. Furthermore, they make the wood more water absorptive, which means that the logs in the finished structure are likely to absorb so much rainwater that they decay.

To avoid stain and mold, logs cut during warm weather should be sprayed or brushed generously on all surfaces with one of the sapstain preventive solutions composed of pentachlorophenol in a vehicle of light oil. These solutions are often obtainable at outlets such as garden supply and hardware stores and marinas. A more economical preservative is the water-soluble sodium salts of pentachlorophenol, but sodium pentachlorophenate is often difficult to obtain. It is not distributed through general channels, but might be secured in bulk through a source such as a local sawmill operator.

For fully effective results in warm weather, the application of such solutions cannot be delayed more than a day after cutting and peeling of the log. If the logs are of some hardwood species, it is advisable to incorporate lindane in the antistain solution to provide insect protection as well. Either the antistain or stain-insect control solution is a desirable safeguard for winter-cut logs also, particularly if the seasoning of the logs continues into spring or summer.

### Preservative Treatment of Logs

If a log cabin is properly constructed and maintained, it should give satisfactory service with a minimum of preservative treatment. This is especially true in the colder and drier parts of the country. Possible minimum treatment includes thoroughly spraying or brushing the exterior of the cabin with a water-repellent preservative solution after erection, as discussed under Exterior Finishing. Since the joints between logs and any checks that occur in the log sides are common water-trapping zones, particular attention should be given to flooding such places with the solution.

Preservative treatments of the spray, brush, or dip type will not adequately protect logs that are exposed to a definite and continuing decay or insect



hazard. Therefore, a more thorough treatment with preservatives can be beneficial to log structures in warm moist areas or for designs that provide little protection against moisture to the exterior (3). For greatest protection, the logs must be impregnated with the preservative before the cabin is built and before the logs are infected. Green or unseasoned logs can be treated either by pressure impregnation after conditioning or by one of the diffusion processes. Seasoned logs can be treated either by pressure impregnation or a cold-soaking process. For best results from any treatment, it is important that the logs be cut to final size and that as much framing as possible be done beforehand.

### Selection of Preservatives

Although many preservatives are effective in preventing decay and insect attack, some of them may not be considered suitable for treating the logs of cabins. Factors that may require attention, for instance, are the color of the preservative and possibly its odor. Among the oil preservatives, pentachlorophenol carried in a light oil results in the least change in color of the logs. Creosote is dark and copper naphthenate is green in color, both of which would be unsuitable if the natural appearance of the logs is to be maintained. Creosote and oils containing pentachlorophenol or copper naphthenate have odors that may be considered objectionable, particularly in recently treated logs. Most waterborne preservatives have little odor, but some of them leave the wood with a blue, green, or brown color, which may or may not be objectionable. If a dark exterior finish such as creosote is to be applied to the cabin, discoloration caused by these preservatives should not be important.

### Methods of Applying Preservative

Pressure impregnation is the most thorough method of treating wood with preservatives but requires extensive equipment and knowhow, such as that found in commercial treating plants. When unseasoned logs are pressure treated, they must first be subjected to a heat conditioning process, such as steaming, whereas seasoned logs do not require such conditioning. A variety of oil or waterborne wood preservatives to meet different use requirements can be applied by pressure (3). Arrangements for pressure treatment of cabin logs or rustic work can be made with commercial wood preserving plants.

Diffusion processes can be used to treat freshly cut, unseasoned logs with waterborne preservatives. Simple diffusion or steeping consists of soaking the wood for a period of 1 to 2 weeks in the preservative solution. In the double diffusion process (2), the wood is first steeped in one and then in a second chemical solution, with the result that the two chemicals react in the

wood to deposit a compound with high resistance to leaching. Another diffusion process employs a proprietary paste that is applied over all surfaces of the log. The logs then are piled closely together and covered tightly for a month or so with a waterproof paper or plastic film. The effectiveness of the various diffusion processes, which are largely noncommercial in type, can vary considerably, depending on the species of wood and how thoroughly they are carried out.

Cold-soaking of seasoned logs in preservative solutions for a period of several days to several weeks also will provide varying degrees of protection, depending on the length of soaking and the species of wood being treated. Only oil preservatives are used for this process, such as a 50-50 solution of coal-tar creosote and light (No. 2) fuel oil, or light fuel oil solutions containing either 5 percent of pentachlorophenol or copper naphthenate with 1 percent of copper metal.

### Treatment of Cut Surfaces

Logs treated by any of the methods described will have to be trimmed and cut to fit into the structure. Such cutting may expose some untreated wood within the logs that could provide entrance for decay or insect attack. All cut surfaces should be retreated by brushing or flooding them generously with a preservative solution, such as strong solutions of the preservative used in the initial treatment. Certain preservative greases or pastes also are widely used for cut surfaces.

### Subsequent Protective Treatments

If the logs are thoroughly treated with a preservative before construction of the cabin, additional protection should be unnecessary. However, if not any or only a minimum amount of preservative treatment has been provided, periodic flooding of end joints and checks with a water-repellent preservative often is advisable.

Such insects as powder-post beetles will attack peeled hardwood logs, even after they are dried and in service. Powder-post beetles (6) work in sapwood of dry hardwood logs and occasionally in softwood logs as well. These beetles may tunnel through and destroy the sapwood to such an extent that considerable damage is done in wood with a high percentage of sapwood. Small piles of wood-dust that have fallen from the logs and numerous small holes in the log surfaces are evidences of attack. Powder-post beetles usually can be killed by thoroughly spraying or brushing the affected wood with 0.5 percent of lindane. Some repetition of spraying or brushing may be necessary before complete control is obtained.



## Details of Construction to Avoid Deterioration

### Foundations

Of first importance in protecting a log cabin from decay or insect damage is the foundation. All too often, log-cabin builders take the course of least resistance and lay the bottom logs directly on or close to the ground. Most people know that placing wood in direct contact with the ground is one of the surest ways of hastening its decay. When wood is placed in contact with the ground, the soil moisture has direct access to the wood and keeps it constantly damp. This dampness sets up conditions that are most favorable for growth of the fungi that cause decay (5).

Good building practice requires that the bottom logs or sills be placed a foot or two above the ground on foundations that will keep the wood dry. Stone or concrete solid foundations or piers are excellent. Good ventilation beneath the floor is important, because it keeps the soil and the wood dry. Foundation posts or piers allow good ventilation, unless the spaces between them are filled solid. Screen or lattice work between the piers will improve the appearance, keep animals out, and still allow good ventilation. Wood lattice, unless made of treated wood, should not touch the ground. If solid foundation walls are preferred to piers, generous openings should be provided at frequent intervals to allow good air circulation. If the building is used throughout the year in the colder parts of the United States, good ventilation will cause cold floors in the winter. This may be prevented by boarding up the openings in cold weather but leaving them open during the rest of the year. When solid foundation walls are used on damp sites, a soil cover of 55-pound or heavier grade roll roofing will help to prevent moisture evaporation from the soil and thereby reduce the decay hazard (5).

In some parts of the country, termites cause considerable trouble to log cabins. The ground-inhabiting termites are the most plentiful and most important type. These termites leave an outside shell of wood intact when working above ground, and may do a great deal of damage without being discovered. Because wood in contact with the ground falls easy prey to these insects, a good foundation offers protection against termites, as well as decay. Masonry or similar foundations, 18 to 24 inches high and free from cracks, may offer sufficient protection, except where the termites are especially active. In using bricks, the joints should be filled with a dense cement mortar, or the termites will tunnel through it. Hollow block foundations should be capped with a layer of reinforced concrete at least 4 inches thick. If termites are very active, they may build mud tunnels over the foundation, until they can enter the wood above. Metal shields properly installed between the masonry foundation and the sill

offer some protection against termites. Protection also can be provided by poisoning the soil around the foundation with one of several chemical solutions, such as 1.0 percent of chlordane, 0.5 percent of dieldrin, 0.5 percent aldrin, or 0.5 percent of heptachlor. Wood properly treated with preservatives is protected against termites, so treatment of the foundation timbers, at least, is desirable.

### Drainage

Good drainage will help keep the foundation dry. If possible, the sides should be graded or ditched, so that water drains away from the building. Storm water should not be allowed to accumulate around the foundation or under the building. Eave troughs, downspouts, and wide eaves direct the water away from the cabin and, therefore, help greatly in keeping the foundation dry.

### Walls

In putting up the walls and in framing the window and door openings, care should be taken to avoid forming crevices where water can accumulate and soak into the wood. Fittings should be made as tight as practicable, and they should be supplemented by calking at places most likely to take up water. Storm water does little harm to the cabin, if it can run off quickly. However, if the water is caught in joints, crevices, or checks, it will soak into the wood and dry out very slowly. Decay may easily start in these damp areas.

The joints between logs are of special concern as possible water-trapping zones. It is important, therefore, that they be suitably chinked. Field branches of the U.S. Forest Service report that one of the most practical methods of chinking is to staple 2-inch strips of metal lath on the outside of the cracks and to chink with standard chimney mortar. The mortar consists of 2 parts of portland cement, 1 part of dry hydrated lime, and 6 parts of clean, sharp, screened sand. This mortar must be mixed in small batches to keep it from hardening before it can be applied.

The Oklahoma State University of Agriculture and Applied Science has reported favorably on a method of chinking with spar varnish, linseed oil, and mineral wool of the kind sold in batts for insulation. Varnish is applied between the logs. Before it dries, rock wool is tamped into place with the end of a board about 3/8 inch thick and 6 inches wide. Varnish or

linseed oil is applied to the exposed surface of the rock wool by sweeping the brush over the surface quickly to avoid deep penetration of the liquid. A brown rock wool can be used on the outside and white on the inside of the building. This chinking adheres tenaciously to the logs. It has enough elasticity to compensate for log shrinkage except where the logs have twisted badly. Where the chinking has broken loose because of such twisting, it can easily be tamped back into place. Insects and rodents are not inclined to attack chinking of this kind.

In general, the interior and exterior walls are chinked in one of two ways:

1. Segments of a log are split out in sizes which fit the opening and, after being carefully shaped with the ax to make a tight fit and are securely nailed in position. This kind of chinking requires considerable work and patience to secure a good appearance.
2. Small round poles may be used to fill the openings. Usually they are cut in sizes and lengths to fill the opening from wall to wall. This sort of chinking may be applied rapidly to either inside or outside walls and makes a neater job than split chinking. Unless the logs are thoroughly seasoned these small poles sometimes pull away from the nails. When the chinking has been completed, the smaller openings will allow the calking material to be applied successfully. Such time-worn chinking materials as moss, rags, and mud have proved neither lasting nor attractive. Only when held in place with strips of wood are they effective, and these increase the number of dust-catching ledges.

One of the most widely used of all chinking substances is oakum. Its popularity is due chiefly to the fact that it can be used in unseasoned log walls; in addition, it is easy to handle and moderately priced. It is not suitable for cabins having wide cracks unless used in connection with willow wands. Being of fibrous texture, it can be tamped compactly into place, even to the exclusion of air, and although the logs may shrink further apart, the oakum will still be serviceable by a little extra tamping. Well-fitted walls need nothing else. If the fit is not particularly good and the oakum shows, a secondary chinking may be desirable, both to improve the appearance and to reduce the fire hazard (oakum is rather inflammable). The logs should be given ample time to season before a secondary chinking is applied.

Tight joints may also be obtained by cutting deep grooves accurately in the top and bottom surfaces of each log and inserting a spline, or by hollowing out the under side of each log carefully to fit the log beneath.

Hard mortars should never be used to chink unseasoned logs. Mortars that are basically cement, lime or gypsum harden quickly and permanently and so are not well-adapted to meet the hygroscopic action of wood. Swelling wood will push the mortar out of a crack or crumble it, and there will be no recession as shrinking takes place. Tests and experience have shown that unless hard mortars are given a backing of reinforcing materials, thus permitting them to get a more solid grip, they can be expected to crumble and fall out within a year or two. A mortar, composed of one part of cement and six of wood fiber plaster, when combined with a strip of metal lath, or a row of galvanized nails has staying qualities of considerable merit, yet, without the reinforcement, it cannot be recommended.

A commercially prepared product known as "calking compound" will furnish very good results because, (1) it retains its plasticity for a long time, thereby being able to withstand the shrinkage and swelling of wood remarkably well; (2) it is easier to apply than the majority of chinking materials, since it can be loaded into and discharged from a pressure gun; (3) used in a gun, a narrow, even line is formed, thus not covering up the logwork unduly, and (4) it is available in many neutral colors in cartridge form, or in bulk. One gallon will fill a crack 275 feet long of average width and depth. It is more expensive than the chinkings previously mentioned, but if labor costs are considered, not excessively so.

Asphalt emulsions, used in combination with such organic substances as wood fiber, or fine sawdust have been tried with varying degrees of success. Like calking compound it remains plastic (in a case-hardened condition) indefinitely, adheres well, except when spread upon a wet surface, and can be applied with a gun. The black color may be objectionable, but it can be changed to suit the taste, after a first coat of asphalt aluminum paint. Actually, with fresh, light-colored logs it serves about the same function as a black mortar outline around fireplace rocks. Care must be exercised in its application, for there is an inclination to produce stains.

Another compound of considerable merit is prepared from flake glue and fine sawdust. It has much the same characteristics as mortar in that it is troweled into place, sets up hard, and is economical to use for rough.

### Roofs

One of the most helpful features that can be incorporated in a log cabin to avoid decay in the walls, foundations, and around doors and windows, is to provide a wide roof overhang. Good projection of eaves and rake of gables will eliminate much rain water that otherwise would flow over the walls. A projection of not less than 18 inches (preferably 24 inches) for a one-story or 24 inches (preferably 36 inches) for a two-story cabin is recommended. The wider overhangs would be particularly desirable in areas with considerable rainfall. Roof-supporting members, whether of logs or sawn lumber, should not project beyond the eaves, or they will become easily wetted and susceptible to decay.

### Finishes

One of the most common questions asked about log cabins is "What is the best finish to use to preserve the logs?" Finishes have practically no value in preserving the logs from decay, and they are only slightly more useful in protecting against certain insects. The use of a finish should be considered primarily from the standpoint of appearance. If the color and surface of unfinished logs are acceptable to the owner, he may very properly leave both the inside and outside of the cabin unfinished. The exterior surfaces of peeled logs will gradually darken and ultimately assume the natural gray of weathered wood, a color that is compatible with rustic surroundings. This is by far the cheapest "finish," because it requires no maintenance or upkeep.

### Interior Finishing

The interior of a cabin when left unfinished gradually darkens in color and becomes soiled, but it does not become weathered or gray. Perhaps the greatest disadvantage of leaving the interior unfinished is that doors and



other woodwork frequently touched by the hands will become soiled in time and cannot be cleaned easily. Soot from a stove or open fireplace may also discolor unfinished wood. When an interior finish is desired, the choice is entirely up to the owner because there is no "best" interior finish for log cabins. Any finish that is used on the woodwork of ordinary houses may be used in cabins.

Rubbed linseed oil finish is one of the easiest to apply and maintain. Several applications of boiled linseed oil should be used. The oil should be brushed on as generously as practicable. After the oil has had about an hour to sink into the wood, any excess oil remaining on the surface should be wiped off with clean rags. Rubbing vigorously will bring up a polish on the logs. At least 24 hours should elapse between applications, so that the oil has a chance to dry thoroughly. Oily rags should be burned immediately or else kept in tightly closed metal containers to eliminate fire hazard.

Instead of boiled linseed oil, a good quality floor seal or wood seal may be used in much the same way. Two applications of floor seal should suffice. Floor seals may be buffed with No. 2 steel wool instead of rags. The buffing should be done before the seal has dried to the point of gumming up the steel wool. The proper time between application and buffing varies for different seals and should be indicated in the directions printed on the label. Furniture or floor wax may be applied for final polish over either the rubbed linseed oil or the floor seal finish.

Shellac varnish may also be used as seal finish. One coat of shellac varnish may suffice. It dries very quickly and should be buffed with No. 2 steel wool after it has dried. It should then be waxed.

After finishing, wood appears darker in color. There is no way of finishing that does not cause some change in color. Moreover, a continued darkening in color usually occurs as time passes due to the action of light on the wood. The darkening goes on less rapidly indoors because the light is weaker. It may show up, however, when a picture or other object is moved after hanging for a long time in one place on the wall. Besides the darkening of the wood, a darkening also takes place from the action of light and air on the oil or seal finish.

Of the three finishes described so far, shellac darkens less than the floor seals, and linseed oil darkens somewhat more than most good floor seals. Shellac, however, does not stand exposure to water or very high humidity as well as floor seal or linseed oil, and it may turn white under such conditions.



If a change in color of the wood is desired, an oil stain may be used alone or in combination with any of the above finishes. The stain is applied to the bare wood. After it dries, the oil, seal, or shellac finish may be applied as already described. On softwoods, however, the difference in absorption of stain by springwood and summerwood may produce too much color contrast. For a more uniform staining, one coat of linseed oil or wood seal may be applied in the manner described. Then, the oil stain may be put on and rubbed with rags in the same way that the oil finish was applied. Another application of oil or seal is then advisable. When the seal finish is being used, oil stain may be mixed with the seal for the first application. Some brands of floor seal come in colors as well as in the plain, uncolored form.

A finish of very light color can be made by combining the oil or seal and light-colored paints. First, one coat of linseed oil or of seal is applied. Next, some white, ivory, or cream-colored house paint or enamel is mixed with the linseed oil or the seal, using 1 part of paint to 3 parts of oil or seal by volume. The mixture is brushed on, and after 20 to 30 minutes, the excess is wiped off with clean rags. Enough paint should be left in the surface of the wood to lighten it materially without giving a painted effect. Another application of clear oil or seal is then advisable.

Before applying any stain or other finish containing color, it is advisable to try the proposed finish on samples of the kind of wood to be used. Cuttings left by the carpenter are excellent for the purpose. By experimenting with such samples, the strength of the stain or the mixture of stain with oil or seal can be varied until the desired effect is produced. Once the application of stain to the woodwork has been started, it is difficult and sometimes impossible to correct mistakes.

If a full varnish finish is desired, it can be obtained by applying three coats of interior varnish of good quality. Since the object is to build up a coating over the wood, the varnish is brushed on evenly and merely allowed to dry. Varnish forms a glossy coating entirely different in appearance from the oil, seal, or shellac finishes. If the high gloss is objectionable, it can be modified by rubbing the last coat with pumice stone and oil after it is thoroughly dry. This rubbing operation is somewhat difficult for the inexperienced. A simpler procedure is to use a flat-drying varnish for the last coat. However, the effect is not so satisfactory as that of a skillfully hand-rubbed finish.

Stain may be used in conjunction with varnish by following the procedures already described for use of stains with oil or seal finishes.

Interior woodwork may also be painted. For this purpose, two products should be used, an enamel undercoater and an interior oil-base paint. Both should be made by the same manufacturer for use together. On new woodwork, the undercoater should be used for the first coat. The last coat should be the interior paint. One coat of each may suffice if the products have good hiding power. If three coats are needed, the middle coat may be one of the undercoater, a mixture of equal parts of undercoater and interior paint, or the interior paint. On this point, the directions given by different manufacturers vary, and it may be wise to follow those given on the labels of the products used.

Interior oil-base paints are made in three degrees of gloss--high gloss, semigloss (low gloss), and flat (no gloss)--and the choice between them is largely a matter of personal preference. As a rule, high gloss paints, which may be selected for the trim, are not desirable for large areas of wall or ceiling because such paints reflect light harshly. Semigloss or flat paints are better for such areas.

### Exterior Finishing

Next to leaving the exterior of the cabin unfinished, the simplest and least expensive procedure is to apply a dark stain. Ordinary coal-tar creosote or any dark stain that is commonly used for the exterior of buildings may be used on log cabins. Whatever stain is used, it is important that it be tested first on a few extra pieces of wood to see whether the appearance is acceptable. A preliminary trial of creosote is particularly important because some creosotes leave a muddy appearance that is very unattractive. Others leave the wood a dark brown at first and then gradually change to a reddish brown in the course of a few months.

Exterior stains penetrate and color wood, obscuring its grain but leaving little or no surface film. They do not crack, curl, flake, or scale and are easy to maintain. A good stain should last 5 to 10 years before needing to be renewed.

Modified stains, sometimes called stains and sometimes natural finishes, have been developed for wood siding on houses and can also be used on log cabins. Such finishes are a compromise between opaque stains, which obscure the grain of the wood, and the transparent natural finishes. The modified stains resemble opaque stains in that they penetrate the wood,

leaving little or no surface film, and are easy to apply and maintain. They contain less pigment than opaque stains, which permits the grain of the wood to show through them and reduces their durability to a point somewhere between opaque stains and transparent natural finishes.

The Forest Products Laboratory natural finish is an excellent finish of the modified stain type, and is made in shades of red and brown to match the colors of redwood and western redcedar. It contains a preservative to prevent mold growth, and paraffin wax which imparts water repellency to the finish. One coat is generally applied on new wood, and tests show that it will last for about 3 years on smooth wood surfaces of siding fully exposed to the weather in Madison, Wis. Reference (4) describes the Forest Products Laboratory natural finish and gives instructions for mixing and applying it.

Many cabin owners try to retain the bright, new appearance of freshly peeled logs by using transparent natural finishes, among which are the boiled linseed oil finish, wood seal sometimes sold as "log cabin," seal, and varnish. All are more expensive to maintain than stain because they lack durability and therefore need to be renewed more frequently. If the cabin stands in the open, fully exposed to sunshine, the transparent finish may need renewal each year. If the cabin is well shaded by trees, however, such finish should last somewhat longer.

Transparent finishes do not prevent the initial darkening that occurs in most woods when they weather with no finish on them. If such finishes are properly applied and maintained, however, they will prevent graying and greatly reduce the roughening of the wood surface that occurs when wood weathers naturally. Transparent finishes offer only moderate protection against absorption of moisture, and untreated wood is sometimes darkened by the growth of blue-stain fungi in the sapwood beneath the finish. The finishes themselves, especially linseed oil, may be darkened by the growth of molds on them if they do not contain a preservative. Such discoloration is likely to be most pronounced on the parts of the cabin exposed to severe dampness, such as the several courses of logs nearest the ground. In the absence of suitable instructions from the manufacturer, a finish that does not contain a preservative can be protected from molds by adding pentachlorophenol in the amount of 5.0 percent by weight of the finish.

It is good practice to treat the exterior of log cabins with a water-repellent preservative before applying a finish, especially a transparent finish. Application may be made by dipping the logs for a few minutes after they have been cut and seasoned and before they are erected. If the cabin has already been erected, the solution may be applied by a thorough brush or spray treatment. The ends of logs and checks, which absorb the solution readily, should be given several applications because they need more protection than other parts of the logs. After the treatment, the solvent of the solution should be allowed to dry from the wood before applying a finish. During good drying weather, 1 week after dipping and 3 days after brushing or spraying should be adequate.

Treatment with water-repellent preservative makes it difficult for water to wet the logs and impedes the accumulation of water in the joints between logs. It is also effective in preventing fungus discoloration on the surface of the logs beneath the finish. When the treatment is used without a finish, the logs will remain somewhat brighter than untreated logs, but the wood will ultimately turn grey. It may be necessary to renew the treatment every year or two to prevent the growth of surface fungi. A superficial application of water-repellent preservative is not recommended as the sole preservative treatment when the logs are exposed to a definite and continuing decay or insect hazard.

For exterior uses, the most readily available transparent finish is the boiled linseed oil finish. It is applied to the exteriors of cabins in the same way that it is applied to the interiors, except that the final waxing is usually omitted out of doors.

In place of linseed oil, one of the commercially available preservative wood sealers may be used. Such products are essentially special kinds of penetrating varnish to which a suitable preservative has been added. Wood sealers may be somewhat more durable than linseed oil.

A finish of unusually light color can be obtained by mixing a little white pigment in the first application of boiled linseed oil or wood sealer and following the procedure prescribed for interior finishing.

A varnish finish is occasionally used on the exterior of log cabins, but the resultant effect is usually considered inappropriate for the rustic environment. If a varnish finish is desired, three coats of a good spar varnish

should be applied. Spar varnishes are always made to dry with a high gloss, and they are not used to produce the rubbed varnish finish. The durability of spar varnish finish is about the same as that of the other transparent finishes, and annual renewal should be expected. After a number of renewals, it may become necessary to take off all old varnish with remover before refinishing.

If oil or sealer finishes are correctly applied and maintained, they need never develop alligatoring, loosening from the surface, cracking, or peeling as varnish finishes eventually do. It should never be necessary to remove old oil or sealer finish before refinishing. Care should always be taken in applying oil or sealer, however, to see that no more is put on than the surface of the wood will absorb. If any excess remains on the surface, it should be wiped off before it dries.

Log cabins can be painted with house paints just as any other exterior woodwork is painted. The effect of paint, however, is more formal than that of stain or oil finishes. For this reason, many owners of log cabins feel that a paint finish is inappropriate for the rustic environment which the log cabin itself suggests.

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