WHY DRY WOOD BEFORE PRESERVATIVE TREATMENT?

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Preservative treatments have enabled wood to become a widely used and economically competitive structural material suitable for conditions that formerly restricted or prohibited its use. Need for improving the durability of this conveniently worked material was evident, no doubt, long before the causes of its deterioration were known. Preservative chemical treatments for wood were being used in Europe early in the eighteenth century, but did not begin to gain importance in the United States until the latter half of the next century (1). Attention then was directed toward processes in which preservative solutions were forced into the wood under considerable pressure. Pressure processes accounted for about 95 per cent of the wood treated in the United States in 1957 (3).

The scope of this discussion is limited to some considerations of the effects of wood moisture on operation of pressure-treating plants, treatment results, and serviceability of treated wood products.

Plant operation

It is usual practice to partially dry wood before attempting to pressure-treat it with an oil-type preservative. Drying practice, which can vary according to species, climatic conditions, and plant facilities, may require air-seasoning yards, drying chambers, or equipment for drying material in the treating cylinder itself.

Air drying, the slowest method, may require a considerable inventory to supply the treating cylinders. Air-dried timber to be treated with oil-type preservative usually is conditioned further within the treating cylinder by the Boulton process, which consists essentially of boiling the material in creosote under vacuum. This process combines additional drying with preheating to facilitate creosote penetration during subsequent pressure treatment.

Unseasoned material also can be dried adequately and conditioned for treatment by the Boulton process. This step eliminates long air-drying periods, but may consume 24 hours or more of cylinder time before pressure treatment can begin. In addition to reduction in cylinder productivity, there are disadvantages in loss of creosote volatiles and difficulty in determining creosote absorption during the conditioning period.

Chamber drying with circulated hot air is a new approach toward preparing material for treatment. It is being used to a limited extent to dry poles and appears to offer some distinct advantages. Dried charges go already heated into the treating cylinder, regardless of climatic conditions, and may be pressure-treated without need of additional conditioning. The improved control of moisture content obtained by chamber drying also permits increased uniformity of treatment with lessened conjecture as to what will be the proper treating schedules for successive charges.
Preservative treatment

The amount of preservative that can be contained in treated wood, is in large part, dependent upon the available amount of void space in the wood cell cavities. Under pressure treatment, preservative solution being forced into softwood timber seeks cell cavities and pit membrane orifices as primary avenues of penetration. Available void space for solution penetration is reduced progressively by increased moisture content until cell cavities are water-filled and flow of solution into otherwise permeable wood becomes impossible. Available void space at different wood moisture contents can be estimated by the formula:

\[ \text{Void Space} = 1.0 - \left[ \text{SG} \left( \text{MC plus 0.67} \right) \right] \]

where \( \text{SG} \) = specific gravity of wood (at oven-dry weight, and volume when measured)

\( \text{MC} \) = moisture content of wood, based upon oven-dried weight.

Thus at fiber saturation point (30 per cent moisture content), any volume of Douglas fir wood having specific gravity of 0.45 is about 57 per cent void space. These calculations are useful for estimating maximum preservation retentions possible in the treated zone of permeable woods. In practice, however, full-cell treatment fills only about 80-85 per cent of available void space of commercial-size timbers (2).

Opinions of operators in pressure-treating plants vary regarding what is an optimum moisture content at which wood should be treated. Moisture-content values near the fiber-saturation point are usually satisfactory. Although wet wood becomes easier to treat as its moisture content is reduced, treatability does not necessarily continue to improve as the wood approaches a completely dried condition. Wood that is difficult to impregnate is likely to become even more refractory after excessive seasoning (2). Permeable wood, however, remains easily impregnated over a wide range of wood moisture contents and treating conditions.

Studies at the Forest Products Research Center on preservative treatment of West Coast hemlock showed an inverse relationship between wood moisture content and creosote penetration and absorption. Pole sections treated at average moisture contents of 40 per cent and higher absorbed about 8 pounds of creosote to a cubic foot of wood and were penetrated to an average depth of 0.5 inch. Sections treated at average moisture contents of less than 30 per cent had twice as much creosote absorption and penetration depth. It is interesting to note, however, that moisture content at extreme depth of solid-black creosote penetration was quite uniform, averaging 24 to 28 per cent among 9 experimental charges treated under a variety of conditions. It also was observed that sections having average moisture contents of less than 25 per cent bled creosote during subsequent storage; sections at moisture contents of 30 per cent or higher did not. Excessive bleeding, which can be minimized by adjustment of the treating process and wood moisture content, is primarily a problem of customer dissatisfaction and possible rejection of those poles that are objectionably messy to handle and climb.
Serviceability

Proper drying is necessary to good preservative treatment and subsequent long serviceability of treated wood. Checks developed during drying of ties, poles, and sizable timbers usually are not cause for degrade unless they impair strength. Improper drying conditions can encourage deterioration before treatment, interfere with treatment, or neutralize the protection obtained by an otherwise good treatment. Of these hazards, the latter is probably the most serious since it will entail expensively premature reinstallation of failing members.

If durability is not to be jeopardized, timber should be sufficiently dried before treatment to avoid subsequent deep checking into unprotected wood. This is important when treating nondurable wood that cannot normally be penetrated deeply with preservative, and is especially important if the material is to be used under conditions which favor decay. Standing utility poles of nondurable species, for example, if checked through the treated wood in the ground-line area, are vulnerable to deterioration at the section where strength is most critical. In such poles the economy of preservative treatment is lost.

In summary, the wood-treating industry necessarily is concerned with problems of wood moisture content and its influence on processing and serviceability of treated products. Excessive wood moisture interferes with preservative penetration and may permit later undesirable checking through the protective treatment. Moisture content too much below the fiber saturation point causes some wood to become more difficult to treat and also may encourage objectionable bleeding of preservative after treatment. Ability of the treating-plant operator to cope with these problems will be reflected by his judgment and care in properly drying and conditioning the timber before treatment, and by adjusting the treating process to obtain the best treatment commensurate with needs of the consumer. Members of the treating industry recognize that the reputation of treated wood can be maintained by consistently providing well-treated products and by diligent search for methods of product improvement.

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