

Hardwood Drying

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*What are Hardwoods?
Why do we care?*

Eastern Hardwoods:

- red oak
- hard maple
- black cherry
- white ash
- soft maple
- yellow birch
- black walnut
- poplar
- hickory
- white oak

These hardwoods tend to be used for high value-added interior-use applications:

- Furniture
- Millwork
- Cabinets
- Flooring

These hardwoods are also used for such industrial and commercial applications as:

- Railroad Crossties
- Pallets

- But these products are typically not kiln dried....

Hardwood Drying, Specifications:

- Kiln dried to 6-7% MC
 - (North American market; European perhaps somewhat higher)
- Without surface, end or interior checking
- Flat
- Without residual drying stress
- Appropriate color

How are these specifications achieved?

- Control the drying process.
- Know the wood.
- Know the customer.
- Always understand and consider the “big picture”.
- Always understand and consider the “little details”.
- It is not easy!!!

The hardwood drying process:

- Drying begins as soon as the tree is cut.
- Manage logs.
- Manage freshly cut lumber.
- Stack and sticker promptly.
- Dry promptly.
 - Air drying yard.
 - Predryer.
 - Kiln.
- Maintain control!!

































Protected Air Drying



Protected Air Drying



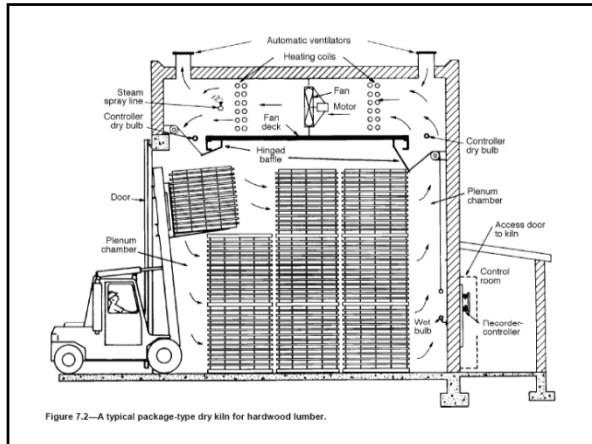
Protect the Ends



















So, how do we dry?

- Kiln Dry.
 - Good quality, productive
- Air Dry, then Kiln Dry
 - Energy savings, kiln utilization efficiency
- Predry, then Kiln Dry
 - Good quality, productive (oak)
- Vacuum Kiln Dry
 - Fast, specialty items,

Kiln Drying Schedules -

- The purpose is to dry as rapidly as possible, to be economical.
- However, drying must be controlled to avoid value reducing defects.
- Typically, the temperature and the relative humidity (wood EMC) are controlled.
- Relative humidity lowered as wood dries.
- When below FSP temperature is raised and relative humidity lowered as wood dries.

Some typical schedules -

Table 2.4—Stages of drying

Stage	Wood moisture content ^a	Major defect risk
I	Green to 2/3 green	Formation of surface and end checks, stain, warp
II	2/3 green to 30% MC	Aggravation of surface and end checks
III	30% MC to final	Conversion of checks to honeycomb, cupping, overdrying
IV	Final	Unequal final MC, casehardening

^aGreen denotes moisture content (MC) in the living tree, not when the lumber is received.

What else do we need to know?

- What is the application?
- What final MC is desired?
 - Interior use? 6-7% MC
 - Exterior use? 12-15% MC
- What is the history – green, air dried, PAD, kiln dried?
- Bacterially infected?
- Pre-existing damage – surface and end checks?

Even more additional issues with oak -

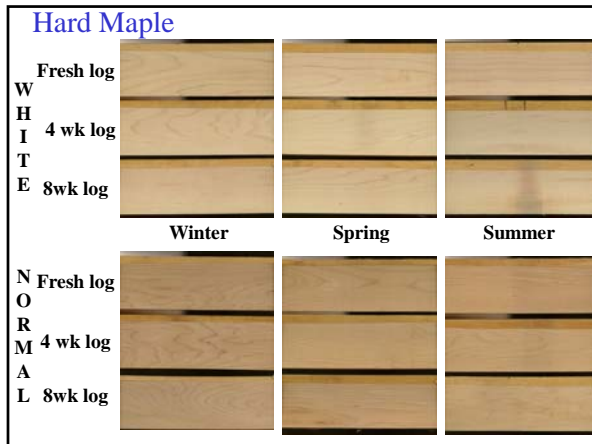
- Evaporated acids from drying are corrosive.
- Regional differences in drying characteristics and value.
- May have bacterial infection.
-
-

Red Oak



Additional issues maples, and other “white woods” including ash and birch -

- Goal is to keep wood as white, and bright as possible.
- Dry as quickly as possible.
- Keep temperature low (under ~ 105 F, 40 C until MC in core is below 20%.





Also,
as wood dries it shrinks,
as wood shrinks,
stresses develop.

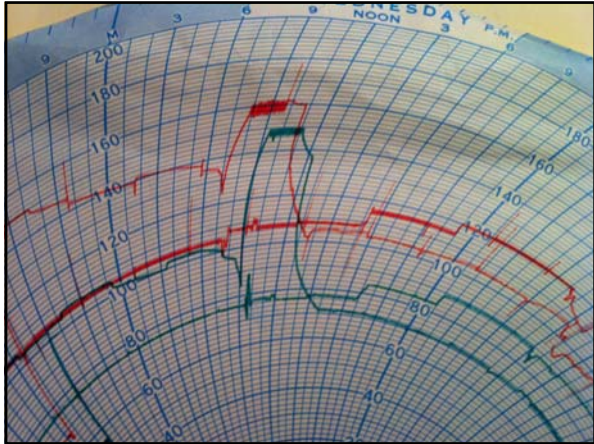


During “Stress Relief”,

- Moisture is added to the “shell” to cause it to try to swell against the core, relieving the stresses.

Stress Relief Conditioning

- High EMC and Temperature
 - Adds moisture
 - High temperature moves moisture faster
 - High temperature means wood is not as strong so stress relieve more readily.







Final %MC checks
This is firewood, not lumber;
but the goal is the same!

Drying characteristics, schedules and other useful information can be found in several sources.

- USDA FPL schedule book.
- FPIinnovations Drying Manuals
- Dry Kiln Operator's Manual
- Drying Hardwoods
- Dry Kiln Association meetings
- Local knowledge.
 - Look to your purchasing agent and contacts in the field.

Thank you!

- Questions?
- Comments?
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