CONTINUOUS LUMBER DRY KILNS

Keith Robertson
Windsor Technology
Wellington, New Zealand

CDK - Continuous Drying Kilns: The Technology Today

This discussion is on "reverse flow CDK" technology. It is based on a case study. Some information is omitted due to commercial sensitivity. The discussion covers the current design status. Current design is more suited to dimension/framing lumber. Future designs may suit appearance grade lumber.

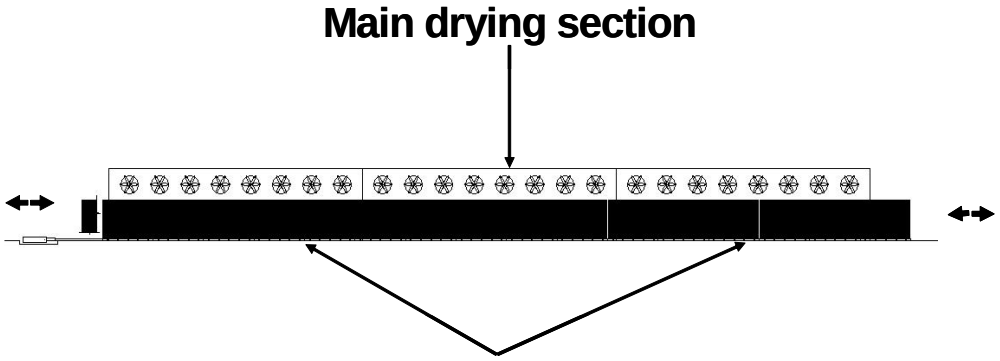
CDK – The Technology Today – A Case Study

Pollard Lumber – CDK-D-HT (to right)
It is a "Pollard design", located in Georgia, USA.

- Double track
- Reverse flow
- High temperature
- Direct fired

Pollard CDK-D-HT Section Drawing
(Shown below)

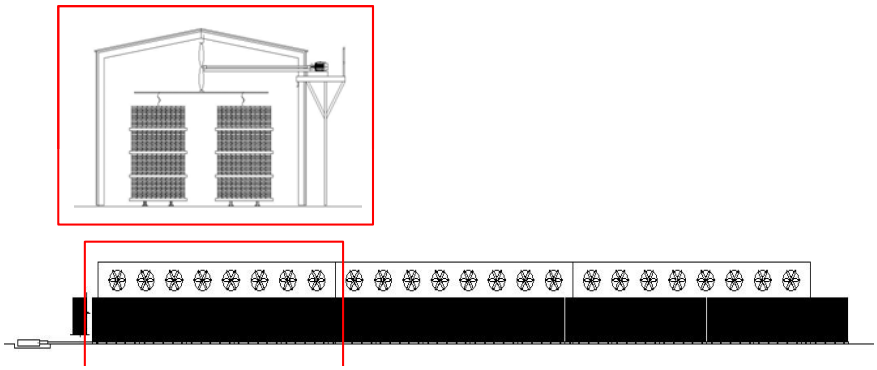
- Standard lumber stacks.
- No doors
- Hydraulic stack advancer system
- Large fans, external belt driven motors
- Wood waste burner - direct fired.



The green lumber first enters a saturated cooling and equalizing section (see below). On the other track in this section is the dry lumber moving the opposite direction.

- No heating medium
- Hot and cold lumber
- No roof vents
- Length = 1x80 feet

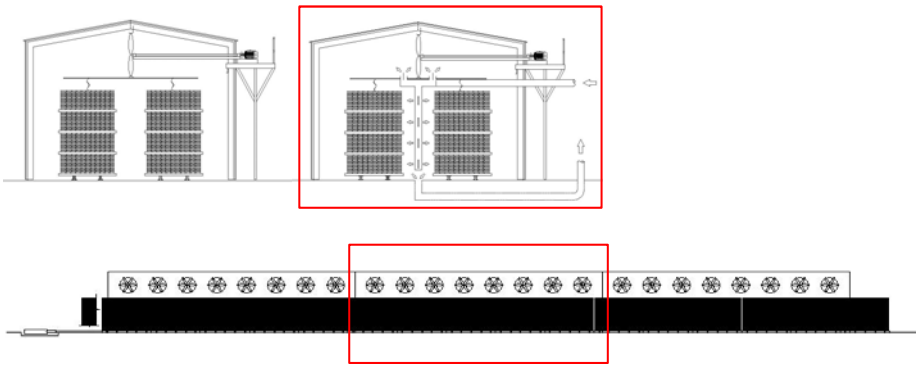
Saturated cooling and equalizing section.



The lumber then moves to the main drying section.

- Hot air supply ducts.
- No roof vents - moisture and its heat move to end sections
- Length = 1 x 80 feet.

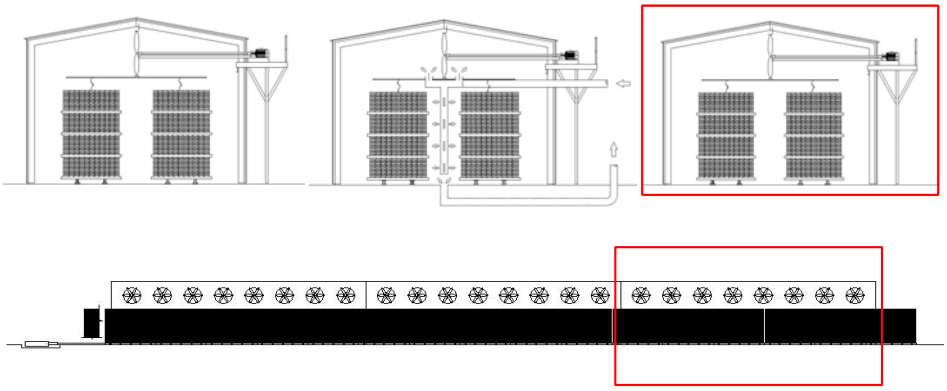
Main drying section



The lumber then moves from the main section to the second saturated cooling and equalizing section. The lumber is now much dryer, but there is green lumber on the adjacent tracks.

- No heating medium
- "Hot" and "cold" lumber
- No roof vents
- Length = 1x 80 feet

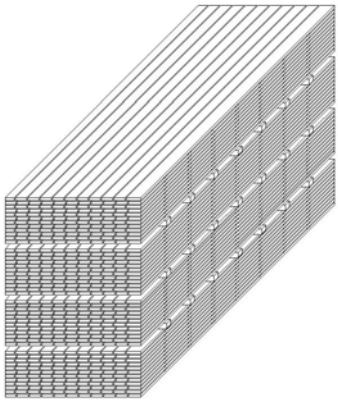
Saturated cooling and equalizing section.



Pollard Lumber CDK-D-HT

Production Capacity - CDK-D-HT

Stack:	8'w x 12'h x 16'L
Chamber:	3 x 80' long double track = 240'
Stacks per kiln	5 stacks x 3 x 2 tracks = 30 stacks
Holding capacity	366 mbdft of 4"x2"



Production Calculations

Drying hours per year: = 365 days x 24 hours x 95% utilization = 8322 hours.

Production Capacity - CDK-D-HT

Temperature set-point (max) = 230/170° DB/WB

Schedule:

Pre-heat:	18 hours
Drying:	18 hours
Equalizing:	9 hours
Saturated cooling	9 hours
Total:	54 hours including the auto advance

Production Capacity - CDK- = D-HT

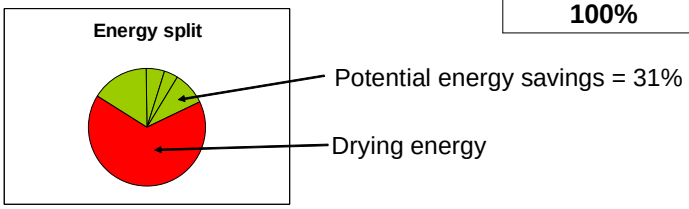
Auto advance rate = about 2 ' per 30 minutes per track

Kiln output rate = 2 x 16' stacks every 4 hours
= 24.4 mbdft

Production: = 8322 ÷ 4 x 24,400
= 50.7 mmbdft per year
= nominally 51 mmbdft

Typical DF Batch Kiln

Batch kiln – Thermal energy split	230/170°F DB/WB 1 day cycle
Heat up kiln/foundation	7%
Heat lumber to WB temperature	6%
Heat water in lumber to WB temperature	10%
Evaporate water in lumber	69%
Roof vent losses	8%
	100%



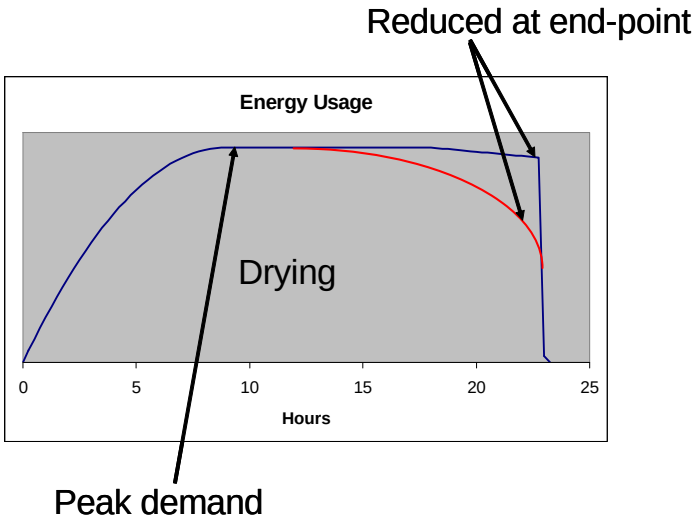
Energy efficiency at Pollard

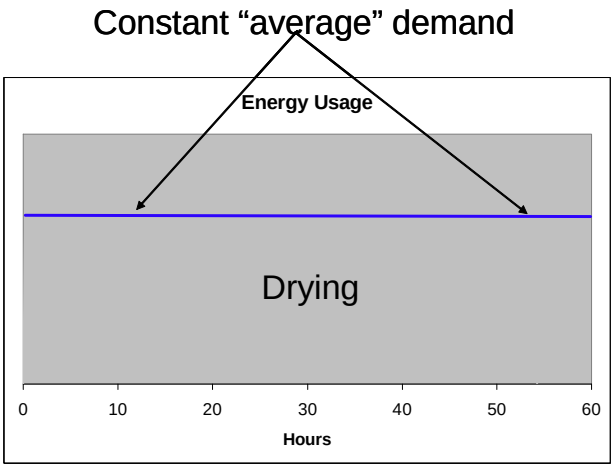
- Transfer of energy from "hot" to "cold" stacks.
- Release of water/steam from "cold" stacks for equalizing.
- Steam from center zone fed to both end zones.
- Constant energy loads, i.e., reduced burner size.

Pollard Experience

- 17 % more production
- same heat source
- plus 18 hours equalizing/conditioning

Energy use in the CDK is more uniform over time. Top diagram shows the energy demand for a batch kiln. Lower diagram shown the energy demand for the CDK.





Electrical energy usage – CDK-D-HT

Schedule	= 54 hours (51mmbdft/year)
Installed fan motor power	= 8 x 22HP + 16 x 11HP = 352HP = 264kW
Total electricity used	= 54hr x 264kW = 14,256kWhr
Lumber dried per charge	= 366mbdft
Energy usage per bdft	= 14,256kWhr ÷ 366mbdft = 39kWhr/mbdft
At say 6c/kWhr	= **$2.34/mbdft**

Electrical energy usage – Batch kiln

Schedule	= 23 hours (44mmbdft/year)
Installed fan motor power	= 8 x 22HP = 176HP = 132kW
Total electricity used	= 23hr x 132kW = 3,036kWhr
Lumber dried per charge	= 122mbdft
Energy usage per bdft	= 3,036kWhr ÷ 122mbdft = 25kWhr/mbdft
At say 6c/kWhr	= **$1.49/mbdft**

CDK-D-HT Unique Design Aspects

Automated in terms of:
- End-point determination
- Loading

High thermal energy efficiency
No kiln doors
No access required into kiln.

Drying Quality–CDK-D-HT

	Boards **9% to 22%** MC	Boards **13% to 18%** MC
Average MC = 15.5% **SD = 2.1%**	**98%**	**66%**

CDK-S-UHT - Layout

Windsor has a license to use the Pollard CDK patent, as have three other companies.

Windsor has two strong differentiating CDK features:
- Both "end sections" are 100% aluminum constructed.
- DryTrack Echo "hands free" in-kiln MC system .