True Zone Control of Lumber Kilns

True zone control of multi-zoned lumber kilns is not accomplished using traditional control methods due to the lack of a variable that precisely compares zone-to-zone drying. During the initial drying period, the traditional coldside temperature method is used. This is probably the best that can be used during the constant- rate drying period; however, coldside control, if continued into the falling-rate period, is ineffective because it finally reaches the coldside temperature setpoint and steam flow levels off to all zones such that there is no "closing the gap" between slower and faster drying zones. This is illustrated by figure (1) which shows the drying rate curves do not converge but are parallel at the end of the charge.

Figure (1) – Drying Rates Vs Time (Traditional Control)

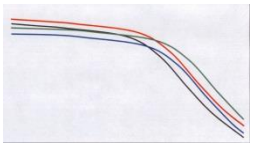

Figure (2) shows that use of true zone control will tighten control by separating the zones at the fiber saturation point (FSP) so they can be controlled to converge throughout the falling-rate period of drying at the target.

Figure (2) – Drying Rates Vs Time -- Improved Control Using Drying Rates & FSPs

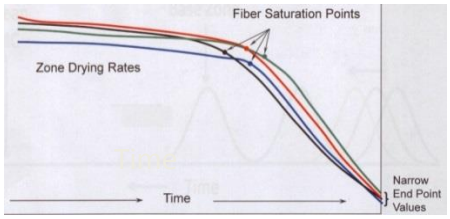

Figure (3) shows zones separated and distributed from highest to lowest drying rates on a horizontal time line with the highest MC on the far right and the base zone is at the lowest MC. Since drying rates are directly proportional to MC, zones are distributed by MC as well starting with the highest MC at the far right and the base zone at the lowest MC. Also, it shows that the base zone (lowest MC) is the first zone to reach the FSP. As each remaining zone reaches its FSP, heat is applied proportional to the time between the base zone reaching its FSP and the time individual zones reach their FSPs, thus all zones are controlled to converge at the target MC. This method insures that the right amount of heat is applied to each zone at the proper time, thus preventing over-drying of the driest zones and preventing under-drying of the wettest zones. As a result, production rate is increased by reducing total kiln drying time, lumber quality is improved by significantly reducing over-drying, and energy is saved as a result of these improvements

Figure (3) – Controlled MC Convergence using Drying Rates