INTERNAL CHECKING IN NEW ZEALAND-GROWN RADIATA PINE AFTER HIGH TEMPERATURE DRYING

D. H. WILLIAMS

Forest Research Institute, New Zealand Forest Service,
Private Bag, Rotorua, New Zealand

Internal checking has limited the use of high temperature drying for radiata pine sawn timber in New Zealand. Research at the Forest Research Institute has shown that internal checking occurs mainly after drying is completed and can be prevented in some sizes, including 100 × 50 mm, by following a precise drying regime including adequate final reconditioning.

INTRODUCTION

Modern high temperature (HT) drying has been used overseas mainly for the drying of construction timber. Use of weighting up to 1000 kg/m^2 of stack top surface allows the timber to be dried rapidly and economically and free from excessive warping. In New Zealand untreated radata pine framing has been HT dried on this basis for export to Australia and there are now five plants with kilns capable of HT drying. As yet none of the plants has a reconditioning chamber (i.e., a steaming chamber for conditioning in steam at 100°C) and any conditioning is carried out in the kiln chamber.

Efforts to HT dry radiata pine for more critical uses such as furniture have not been satisfactory mainly because of the development of internal checking which, in 100 × 50 mm, has been reported as particularly serious.

It was originally thought that this checking must occur during drying, but investigations on 2.4 m lengths of high temperature dried material showed that this was not correct and that the checking formed after the boards were removed from the kiln. Further studies established that such checking did not occur if the material was adequately steamed after drying, although checking in the end few millimetres of boards was often still severe and should be removed by docking.

RESULTS AND DISCUSSION

Table 1 gives a summary of results for charges of 30 boards (each 2.4 m long) dried at 115°/70°C for the stated times. Settings were reached in one hour and air-flow was 5 m/sec. Boards to be steamed were removed from the kiln immediately and placed in a steaming chamber at the end of drying.

Internal checking was recorded in only 3 of the 90 reconditioned boards. The slight checking observed occurred in abnormal zones — one in a resin-impregnated area, the other two in severe cross-grain.

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Longitudinal internal checking in boards usually consisted of one (more rarely two) large splits (Fig. 2) and "end" checking is typically a scatter of numerous checks from small to large as shown in Fig. 3.

Other findings from these and earlier studies were that:

(a) internal checking occurred as readily in heartwood as in sapwood;

(b) density was not a determining factor;

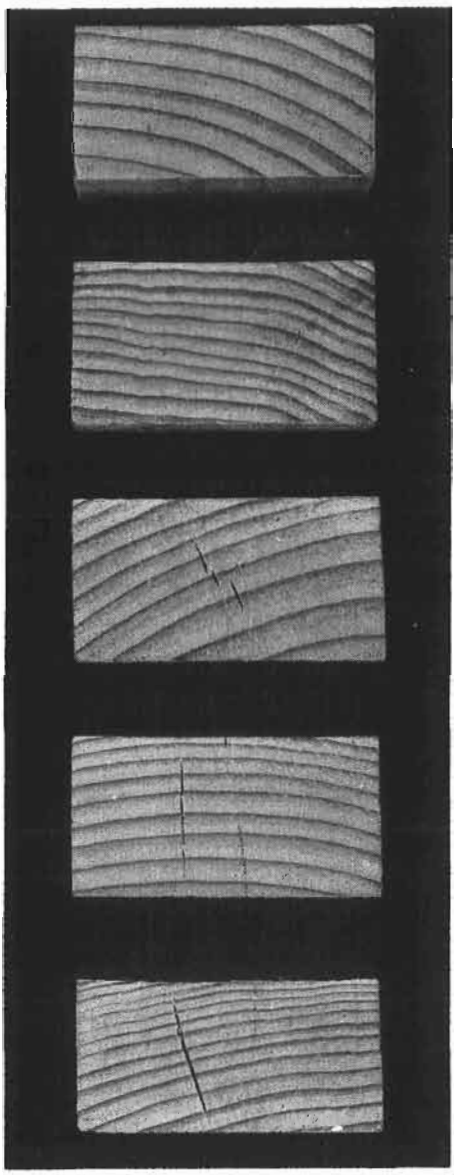

FIG. 1—Internal check severity ratings; from top: very slight, slight, moderate, severe, very severe.

TABLE 1—Summary of standard charges

Hours drying 115°/70°C	Steaming (hours) 100°C/100% rh	Cool in stack for	Number of boards internally checked	Up to a severity rating of (see Fig. 1)
20	—	1 week	15	Very severe
20	4	1 week	1	Slight
24	—	1 day	9	Very severe
24	—	1 week	16	Very severe
24	4	1 week	—	—
30	—	1 week	19	Very severe
30	4	1 week	2	Slight

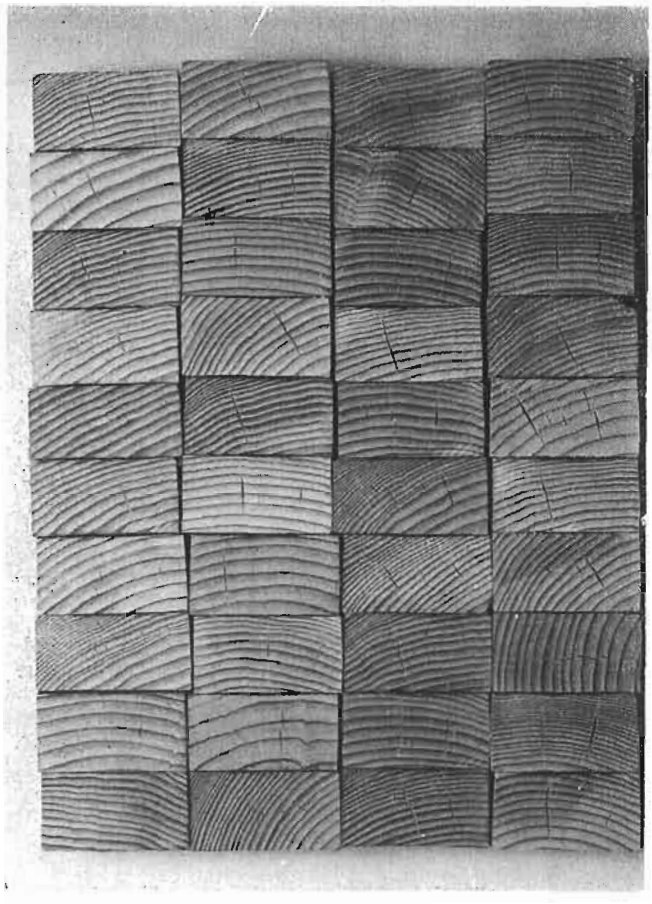

FIG. 2—Typical internal checking found in unreconditioned boards.

(c) inadequate air flow, inadequate heat input, or any other factor causing slower drying was detrimental.

All reconditioning was in a separate steaming chamber. It is recommended that such a chamber should be regarded as being as important as the kiln and all steaming should be done in it.

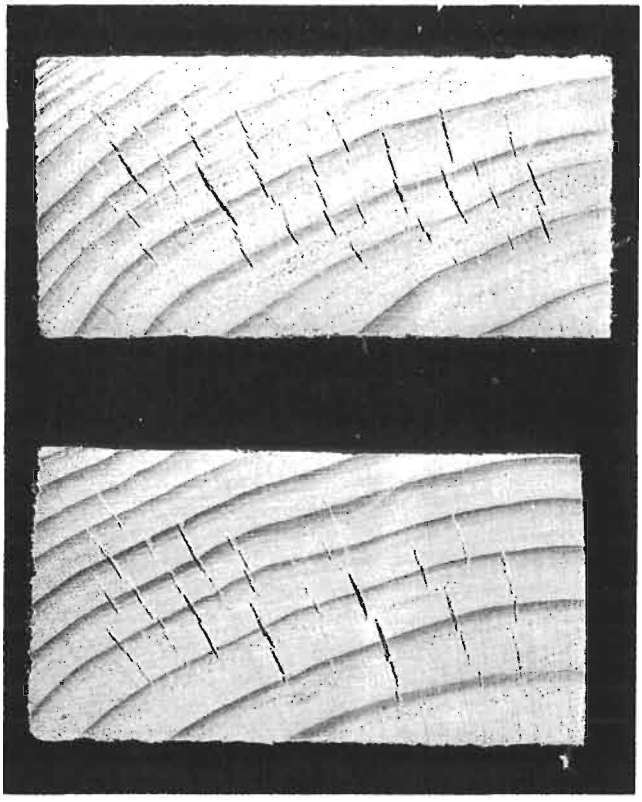

FIG. 3—Some checking at the end of the board is inevitable in HT drying: this photograph shows typical end checks.

Conditioning in the kiln at 80°C for 4 hours after a necessary cooling period produced significant surface checking when the conditioning was at 100% relative humidity, and did not prevent internal checking when the relative humidity was 80%, a level often found in commercial kilns during the final high humidity treatment.

Results of these studies show clearly that steaming in a reconditioning chamber is more effective than conditioning in a kiln. In addition, a reconditioner is a simple chamber without fans or heating coils, costing a quarter as much as a kiln and having lower maintenance costs. Thus overall drying costs are reduced (despite some extra handling) and can be even lower because a single reconditioner can service 3 kilns.

Using a reconditioner, it may be possible to kiln dry on an efficient 24 hour cycle where conditioning in a kiln would throw this out of sequence.

CONCLUSIONS

From these studies on high temperature drying of 25 mm and 50 mm material it is recommended to New Zealand firms that high temperature drying be based on:

(a) material green off saw, using
(b) a temperature of 115°C or higher,
(c) wet bulb setting of 70°C,
(d) settings being reached as rapidly as possible,
(e) air flow of 5 m/sec or above,

(f) drying until no piece has a moisture content higher than 10%,
(g) drying immediately followed by 4 hours reconditioning at 100°C, 100% rh in a separate steaming chamber,

in stacks that have

(a) boards sawn as accurately as possible,
(b) fillets of uniform thickness precisely aligned,
(c) no overhanging ends,
(d) weighting at least 1000 kg/m^2 top surface.

If these guidelines are followed it is anticipated that there will be few problems in high temperature drying most 25 and 50 mm sizes of untreated radiata pine sawn timber. Such a drying regime can result in a stress-free, stable, low moisture content product suitable for a full range of uses.