

# THE ADHESIVE SYSTEM FOR FINGER-JOINTING GREEN LUMBER

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## Abstract

The Greenweld® Process is a dynamic new technology that gives the wood products industry a tremendous opportunity to improve recovery and create a value-added product. Finger-jointing green lumber gives the primary sawmill manufacturers the ability to convert hog fuel into a vertical stud or horizontal dimension product. The remanufacturer has the opportunity to supplement their raw material supply with green lumber and have a high quality structural glue to use in any application.

The history of the Greenweld® Process validates its exceptional flexibility and thorough development. The government of New Zealand commissioned the Forest Research Institute (FRI) to look at possible recovery of clear material from fast growing radiata pine. The maturing radiata plantations had 3 to 5-foot of clear bore holes between large, weak knot clusters. The focus of the research would be to recover this clear material and better utilize precious kiln space. FRI started their research efforts in 1988. Because of the increase in finger-jointers, the research centered on the possibility of defecting and gluing in the green before kiln drying. After two years of research, the project advanced to the field trial stage. From 1990 until 1992 the process was tested under a variety of conditions with a number of different softwood and hardwood species. The first Greenweld® mill was commissioned in early 1993 and has run successfully since that time. Greenweld Technologies Limited of New Zealand has six operating mills in New Zealand, one mill in Australia, one mill in the United Kingdom, and one currently being developed in Sweden.

The Greenweld® technology in the United States went through a long uptake period until Bruce Engel, President and CEO of WTD Industries looked at the process during a trip to New Zealand in January 1997. After a series of discussions with New Zealand, WTD Industries became the exclusive distributor for the technology and formed Greenweld North America Co. as a subsidiary to promote the process. During that period a remanufacturing facility was constructed in Corvallis, Oregon. Midway Engineered Wood Products (MEWP) was designed and built to showcase the Greenweld® technology in a high production environment. The final plans were drawn in April, the slab was poured in May, the 40,000 foot square building erected and equipment installed in June. The first finger-jointed board using the Greenweld® Process was manufactured on July 3, 1997. Since that time, the production and efficiency of the mill has improved dramatically and the Greenweld® Process has proven itself at every turn.

## Key Attributes of the Greenweld® Process

- (1) The Greenweld® Process is a proven method of finger-jointing green lumber. Research and Development has been ongoing throughout its 10-year history with a proven commercial track record since the first mill was commissioned in 1993.
- (2) The Greenweld® Process is extremely flexible with a capacity to glue any combination of moisture content pieces; wet to wet (up to 180 percent), dry to wet 9 to 150 percent successfully in radiata pine) or dry to dry. Greenweld® eliminates moisture from the finger-joint equation.
- (3) The Greenweld® Process works on all conventional finger-jointers (vertical or horizontal design), with no major modifications required for the Process.
- (4) The Greenweld® Process is **not** a honeymoon system where one part of the system is applied on one end of the block and the second part to the other end of the block. By applying both steps to one end of the block you dramatically reduce your waste steam and simplify the operation. The honeymoon system is not accepted under Canadian SPS1 rules. Greenweld® is currently working with Canadian regulatory authorities to certify the Greenweld® Process for SPS1.
- (5) The Greenweld® Process has a five minute closed press time, providing flexibility in production while obtaining a fast bond which is millable in less than 10 minutes. This closed press time eliminates waste and concern over joint stability that can occur with glues that have extremely short closed press times.
- (6) Because of the scavenging effect of the activator on the formaldehyde within the resin, the toxic emissions are very low compared to other normal phenol resorcinol formaldehyde resins or other structural adhesives. The glue becomes inert once fully cured with no toxic elements in the final product.
- (7) The Greenweld® Process has been shown to cure in wet wood down to 32°F. The process can successfully glue frozen wood, eliminating the need to heat blocks prior to finger-jointing.
- (8) The Greenweld® Process does not require preheating or RF curing, eliminating the need for additional storage facilities and expensive machinery.
- (9) Because of its tough waterproof bond, any Greenweld® product can be placed in extreme environments and perform without any concerns of joint deterioration.
- (10) Greenweld® lumber has been successfully pressure treated using the Chromium Copper Arsenic (CCA) and Ammoniacal Copper Zinc Arsenate (ACZA) with no adverse effects on the joint.

- (11) The Greenweld® Process is supported world wide by top resin manufacturers: Dynochem UK, ICI Adhesives and Resins (Australia and New Zealand) and Georgia-Pacific Resins in North America. These companies have all examined the Greenweld® Process in detail before agreeing to support it.
- (12) The Greenweld® Process works on all medium density softwood species. For example: Douglas-fir, hemlock, southern yellow pine, jack pine, ponderosa pine, balsam fir, grand fir, western red cedar, black spruce.
- (13) Midway Engineered Wood Products is a dedicated, high production mill using the Greenweld® Process producing 2x3-inch, 2x4-inch, and 2x6-inch studs, along with 2x3-inch, 2x4-inch, and 2x6-inch dimension.
- (14) The green engineered product which has been sold from Midway Engineered Wood Products has had a tremendous reception in the marketplace. The produce provides the structural stability of a kiln dried product (no warp, twist or bow) along with the workability of a green product (cutting and nailing).
- (15) The products produced and shipped to date have all exceeded their design value by 5 or 6 times. Tests conducted by the Western Wood Products Association for certification of both vertical and horizontal included: (a) bending sites, (b) tension tests, (c) cyclic delamination tests, (d) oven dried versus air dried comparison studies, and (e) minimum cure time studies.

In order to qualify for CERTIFIED EXTERIOR JOINTS (horizontal use), the American Lumber Standard Committee required that the glue activator meet the American Society for Testing and Materials (ASTM) D-2559 standard. The Greenweld® Resin, the Greenweld® Hardener (from Georgia-Pacific Resins, Inc.) and the Greenweld® Activator (from Great Western Chemical Co.) have been tested in compliance with ASTM D-6488 and the results were found to meet the requirements of ASTM D-2559.

**Note: Wood Failure for Horizontal Certification:** Test samples were required to average at least 70% wood failure.

**Actual Results:**

	Green	Dry (%)	
2x3	93	98.3	Wood failure
2x4	90	98.4	Wood failure
2x6	94	99.6	Wood failure

**Note: Cyclic Delamination for Horizontal Certification:** Test samples were required to average no more than 5% delamination.

**Actual Results:**

2x3	.29%	delamination
2x4	.24%	delamination
2x6	.19%	delamination

- (16) Greenweld® has received a United States Patent (US Patent #5,674,338). The patent is unique in that it covers a process where an activator is applied to a phenol resorcinol formaldehyde resin.

**Greenweld North America Co. has signed three end users for the process.**

Avison Wood Specialties  
Molalla, Oregon

Stillwater Forest Products  
Kalispell, Montana

Caliber Forest Products  
Turner, Oregon

Greenweld® has received strong interest from Canada where SPS1 Certification is currently under review, the U.S. South, northeast, and northwest. The flexibility of the Greenweld® Process allows end users the ability to produce vertical studs dimension, stock for pressure treated products, and eliminates the worry of product failures in difficult environmental conditions.

Greenweld North America has been actively testing new markets. MEWP has conducted full production trials on southern yellow pine, western redcedar, and eastern hard maple with excellent results. Future plans include production trials of redwood, red oak and pine. Future products for Greenweld® revolve around both edge-gluing and face gluing. New Zealand is currently undergoing a number of research trials producing excellent results. Other products being examined in research work with major midwest and east coast universities are with pallets, van and truck flooring and low grade hardwood recovery.

Greenweld North America is available to conduct tours through the Midway facility at any time. In September 1997, over 60 people attended the Forest Products Society Tour, representing a broad spectrum of the primary and secondary wood products industry, the adhesives industry and researchers from Oregon State University.

Greenweld North America can provide technical assistance to refit existing finger-joint facilities for the Greenweld® Process or working with companies to develop complete turnkey operations.