

# TECHNICAL NOTE NUMBER 211

FOREST PRODUCTS LABORATORY · U. S. FOREST SERVICE · MADISON, WISCONSIN

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## STRONG AND WEAK GLUE JOINTS

The accompanying photographs of glued-up wooden blocks sheared apart in testing at the Forest Products Laboratory show what may happen with the same glue rightly and wrongly used. The blocks that sheared apart at the glue line indicate poor gluing. Those in which failure occurred in the wood were good joints, as strong as the wood itself.

The joints shown in the left-hand column were weak, since the failure was all in the glue. In joint A the glue was allowed to get too cold before pressure was applied. In joint B the glue was too thin and was squeezed out of the joint. In joint C the glue had dried before pressure was applied. These three joints represent three of the most common errors in gluing practice. They are known as the chilled joint, the starved joint, and the dried joint.

The joints shown in the rows to the right of A, B, and C are strong joints, each made by changing only one of the three conditions—pressure, assembly time, or temperature. These are the three most important variables in the gluing operation when animal glue is used.

Thus a good joint can be made from chilled glue by increasing the pressure, or the glue may be kept from getting chilled and a good joint obtained if either the assembly time is decreased or the room temperature increased. (See the top row of photographs, left to right.)

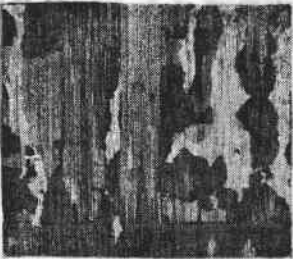
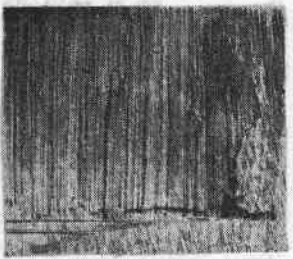
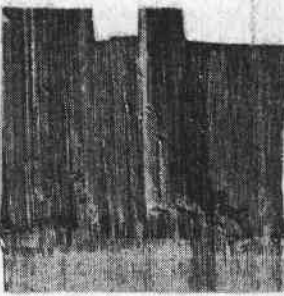
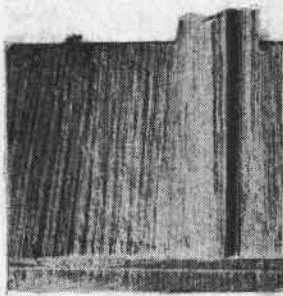
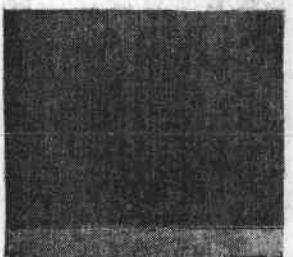
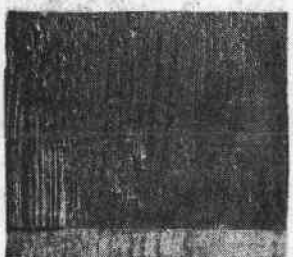

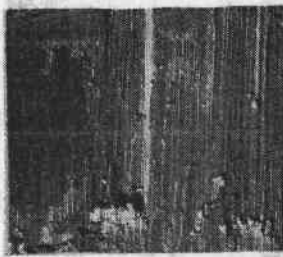



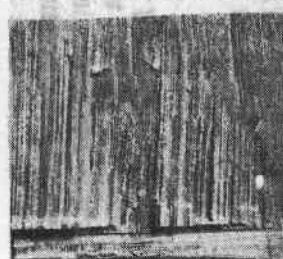
If the glue is thin, starved joints may be avoided by decreasing the pressure, although such practice is not always recommended. Better average results are obtained

if the consistency of a thin glue is increased either by increasing the assembly time or by decreasing the room temperature. (See the middle row of photographs.)

No amount of pressure will produce a good joint from dried glue, but by decreasing either the assembly time or the temperature to which the wood is subjected, a good joint can be made before the glue has dried out. (See the bottom row of photographs.)

Assembly time, room temperature, and wood temperature are chief among the factors affecting the consistency of an animal glue at the moment pressure is applied. Pressure then must be adjusted to suit the consistency of the glue, the thicker mixture requiring the more pressure.

## THREE COMMON TYPES OF WEAK ANIMAL GLUE JOINTS AND HOW THEY MAY BE AVOIDED

<b>POOR JOINTS</b> <b>THREE TYPES MADE UNDER THREE DIFFERENT SETS OF CONDITIONS.</b>	<b>GOOD JOINTS</b> <b>MADE UNDER SAME CONDITIONS AS POOR JOINTS TO LEFT EXCEPT FOR A VARIATION IN EACH CASE OF ONE OF THE THREE FACTORS</b>		
	PRESSURE	ASSEMBLY TIME	TEMPERATURE
 <p><b>A-CHILLED JOINT</b>  Medium glue spread.  Pressure of 150 pounds per square inch applied after 12 minutes closed assembly. Room at 75° F. Note areas of incomplete contact.</p>	 <p>Pressure 400 pounds per square inch. All other conditions same as for A.</p>	 <p>1 minute closed assembly before application of pressure. All other conditions same as for A.</p>	 <p>Room at 90° F. All other conditions same as for A.</p>
 <p><b>B-STARVED JOINT</b>  Medium glue spread.  Pressure of 150 pounds per square inch applied after 1 minute closed assembly. Room at 90° F. No glue remaining in joint. No wood failure.</p>	 <p>Pressure 25 pounds per square inch. All other conditions same as for B. Better joint than B, but this pressure not recommended.</p>	 <p>12 minutes closed assembly before application of pressure. All other conditions same as for B.</p>	 <p>Room at 75° F. All other conditions same as for B.</p>
 <p><b>C-DRIED JOINT</b>  Medium glue spread.  Pressure of 150 pounds per square inch applied after 25 minutes closed assembly. Wood heated 20 minutes at 120° F. Room at 80° F. Note shiny areas of dried glue.</p>	 <p>No amount of pressure will produce a good joint with other conditions same as for C.</p>	 <p>12 minutes closed assembly. All other conditions same as for C.</p>	 <p>Wood heated 20 minutes at 90° F. All other conditions same as for C.</p>