

## IMPORTANT FACTORS IN GLUING WITH ANIMAL GLUE

Many factors which affect the strength of the joint enter into the use of animal glue. Pressure; length of assembly period; kind of assembly; temperature of wood, glue and assembly room; amount of spread; grade of glue and water content, all play an important part in gluing practice. It is doubtful, however, if the real importance of some of these things is generally understood. With such a large number of factors many combinations, of course, are possible; some will have good, others poor, results. To work out a successful combination, the glue operator should know the effect of all the various factors.

In factory gluing operations certain factors are generally predetermined by the conditions in the plant. These conditions differ, naturally, in different shops, or perhaps even vary in the same plant, if different products are manufactured. Here the choice is restricted, but it is usually possible to alter enough factors to secure a combination that will give satisfactory results.

The proper pressure to use is determined by the condition of the glue at the moment pressure is applied. If the factory requirements are such that the pressure must be applied while the glue is very thin, a low pressure, such as 25 to 50 pounds per square inch, is best. The use of such low pressures presupposes smooth, true wood surfaces. If pressure must be applied after the glue has become very thick or has chilled, high pressures of 400 pounds per square inch or more should be used. It is best practice to govern the other factors so that pressures between these two extremes may be used. In most commercial gluing operations pressures of 150 to 200 pounds per square inch will give good results.

Length of assembly period means the length of time which elapses between spreading the glue and applying pressure. Long assembly periods result in thickened or chilled glue, while with short assembly periods the glue may still be thin at the time pressure is applied. If long assembly periods (15 minutes or more) are necessary, high pressures are required, or some other factor must be varied to retard the thickening of the glue. On the other hand, if short assembly periods (3 minutes or less) are required, either low pressures should be used or something should be done to hasten the thickening of the glue. In the experiments at the Forest Products Laboratory periods of 8 to 12 minutes for closed assembly were considered most desirable, in general.

Kind of assembly refers to whether the faces of the joint are placed together immediately after spreading and allowed to wait in this condition until pressure is applied, or whether they are allowed to remain with the glue faces exposed to the air until just before pressing. Closed assembly is customary in commercial gluing practice and is usually best. Open assembly allows more rapid drying and cooling of the glue, and thus hastens its thickening. Open assembly periods must be short if poor joints are to be avoided, but in cases where short assembly periods are necessary open assembly may be advantageous.

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Wood is sometimes heated before gluing. Glue cools and thickens more slowly on heated wood than on wood at ordinary temperatures. If long assembly periods are necessary, heating the wood may be an advantage; but with short assembly periods it may be a distinct disadvantage. When gluing is done at ordinary room temperature it is seldom necessary to heat the wood unless conditions require slow thickening that cannot be better accomplished in some other way.

The temperature of the glue room has an effect similar to the wood temperature. Room temperatures of 70° to 80° F. are ordinarily satisfactory. There is no advantage in cooling the room below this range, and it is seldom necessary to have the temperature higher. If considerable time is required in assembling parts spread with a high-grade glue, room temperatures of 90° and above may be useful in retarding the thickening of the glue.

The glue temperature should ordinarily be 140° to 150° F. Higher temperatures tend to reduce the strength of the glue; lower temperatures favor bacterial decomposition, and may cause the glue to become too thick to spread well. The temperatures of the wood and the room are more important than the temperature in the glue pot in determining the rate of thickening of the glue in the joint.

In the laboratory work, 20, 35, and 50 grams of wet glue per square foot (combined spread of both faces) are considered light, medium, and heavy spreads, respectively. These correspond to spreads of about 73, 43, and 30 square feet of single glue line per pound of dry glue, mixed one part to 2-1/4 parts of water. For short assembly periods, heated wood, and warm rooms, light glue spreads are likely to prove better than heavy spreads, because a thin film of glue thickens faster than a heavy film. When it is desired that the glue film should thicken very slowly thick spreads are advantageous.

Ordinarily it is best to use a reasonably good grade of glue, but if the gluing conditions are properly controlled strong joints may be obtained with glues of relatively low grade. This offers an opportunity to effect economy in operation. On the other hand, incorrect gluing conditions, even with the highest grade glues, are likely to give poor results. When gluing troubles are encountered the explanation is much more likely to be in the gluing operations than to some inherent weakness of the glue.

The thickness or consistency of the glue can be regulated to some extent by the water content, although there is a limit to the amount of water that can be added. A high grade of glue which works well at a dilution of one part of glue to 2-1/4 parts of water, may also give strong joints with a 1 to 3 dilution if the gluing operation is properly controlled. Low-grade glues require less water.

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