

TECHNICAL NOTES

FOREST PRODUCTS LABORATORY

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CALCULATION OF PRESSURE IN A HYDRAULIC VENEER PRESS

Results of experiments at the Forest Products Laboratory, Madison, Wis., indicate that an excess or lack of pressure in gluing plywood tends to weaken the glue joint materially. This fact suggests the importance of knowing the amount of pressure per unit area which is being applied to any panel.

The pressure gauge reading must vary with the size of the panels if the same amount of pressure per square inch is to be secured. For example, if the same gauge pressure is applied on panels 10 by 36 inches and 36 by 40 inches, the pressure per square inch will be approximately four times as great in the first case as in the second.

The formula for the calculation of pressures may be written:

$$G = \frac{P \times A}{R} \quad (1) \quad \text{or} \quad P = \frac{G \times R}{A} \quad (2)$$

where
G = gauge pressure in pounds per square inch
P = pressure on panels in pounds per square inch
R = area of piston or ram in square inches
A = area of panel in square inches

To illustrate the use of the formula, let the following case be assumed: On a hydraulic press with a 10-inch piston, what pressure gauge reading is necessary to secure 75 pounds per square inch on panels 24 by 48 inches? Use formula as in (1),

$$G = \frac{P \times A}{R}$$

Here
G = gauge reading required
P = 75
A = 24 x 48 or 1152 square inches, (area of panel)
R = 3.1416 x 5² or 78.54 square inches (area of piston)

Thus $G = \frac{75 \times 1152}{78.54}$ or 1100 pounds, the required gauge reading.

Suppose the operator of the press should use the same gauge reading of 1100 pounds in pressing panels 8 by 36 inches. What would be pressure on the panels in pounds per square inch? Here use formula as in (2),

$$P = \frac{G \times R}{A}$$

P = pressure actually secured on panel

G = 1100

R = 78.54

A = 8 x 36 or 288

Then $P = \frac{1100 \times 78.54}{288}$ or 300 pounds per square inch, which is four times that used on the larger panels.

A table, showing gauge readings to be used for all the sizes of panels manufactured and for the different pressures used, may be computed, and placed near the press where the operator may see at a glance the gauge reading required for each run of panels. It is advisable to check the accuracy of the pressure gauge occasionally.

Note: To determine the exact pressure secured, the weight of the platen to which the pressure is applied must be taken into consideration. For practical purposes, however, it may be omitted from the calculation, as inaccuracies in the gauge reading, etc., may account for much larger errors. When included, the formula becomes:

$$G = \frac{P \times A}{R} \text{ plus or minus } \frac{W}{R} \quad (3)$$

or $P = \frac{G \times R}{A} \text{ minus or plus } \frac{W}{R} \quad (4)$

Where W = weight of lower platen plus weight of panels or upper platen alone, as the case may be. The sign of the last member of equation (3) is plus when the pressure is applied by the lower platen, and minus when applied by the upper. In equation (4) the reverse is true.