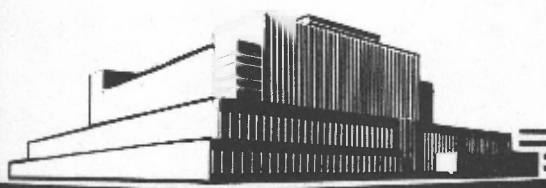
BEARING STRENGTH OF WOOD AT ANGLE TO THE GRAIN

No. 1203

Revised March 1956



FOREST PRODUCTS LABORATORY
MADISON 5, WISCONSIN

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
In Cooperation with the University of Wisconsin

BEARING STRENGTH OF WOOD AT ANGLE TO THE GRAIN[1]

By

Forest Products Laboratory,[2] Forest Service
U. S. Department of Agriculture

The compressive strength of wood depends on the direction of the grain with respect to the direction of the applied force. It is highest parallel to the grain and lowest perpendicular to the grain, and for other angles has intermediate values. The ratio between the values perpendicular and parallel to the grain are not the same for different species of wood and also vary with the method of applying the load. For example, the basic stress of Douglas-fir is 1,450 pounds per square inch parallel to the grain and 235 pounds perpendicular to the grain, while for oak these respective values are 1,350 and 365. The safe load on a 1-inch bolt in a 6-inch Douglas-fir timber is 5,840 pounds parallel to the grain and 2,440 pounds perpendicular to the grain.

On account of this variation in the magnitude and relationship of the compressive strength parallel and perpendicular to the grain, the determination of the proper value for intervening angles has always been a difficult problem in timber design. To present values in tables for all the conditions would be impracticable. The bearing values for intervening angles, therefore, are usually obtained from the values parallel and perpendicular to the grain by the use of the Hankinson formula. This, however, involves a separate calculation for each individual condition and in order to provide a more convenient method the accompanying nomograph, based on the formula, has been developed by John A. Scholten of the U. S. Forest Products Laboratory.

The nomograph is based on the Hankinson formula, which is considered most applicable by the U. S. Forest Products Laboratory.

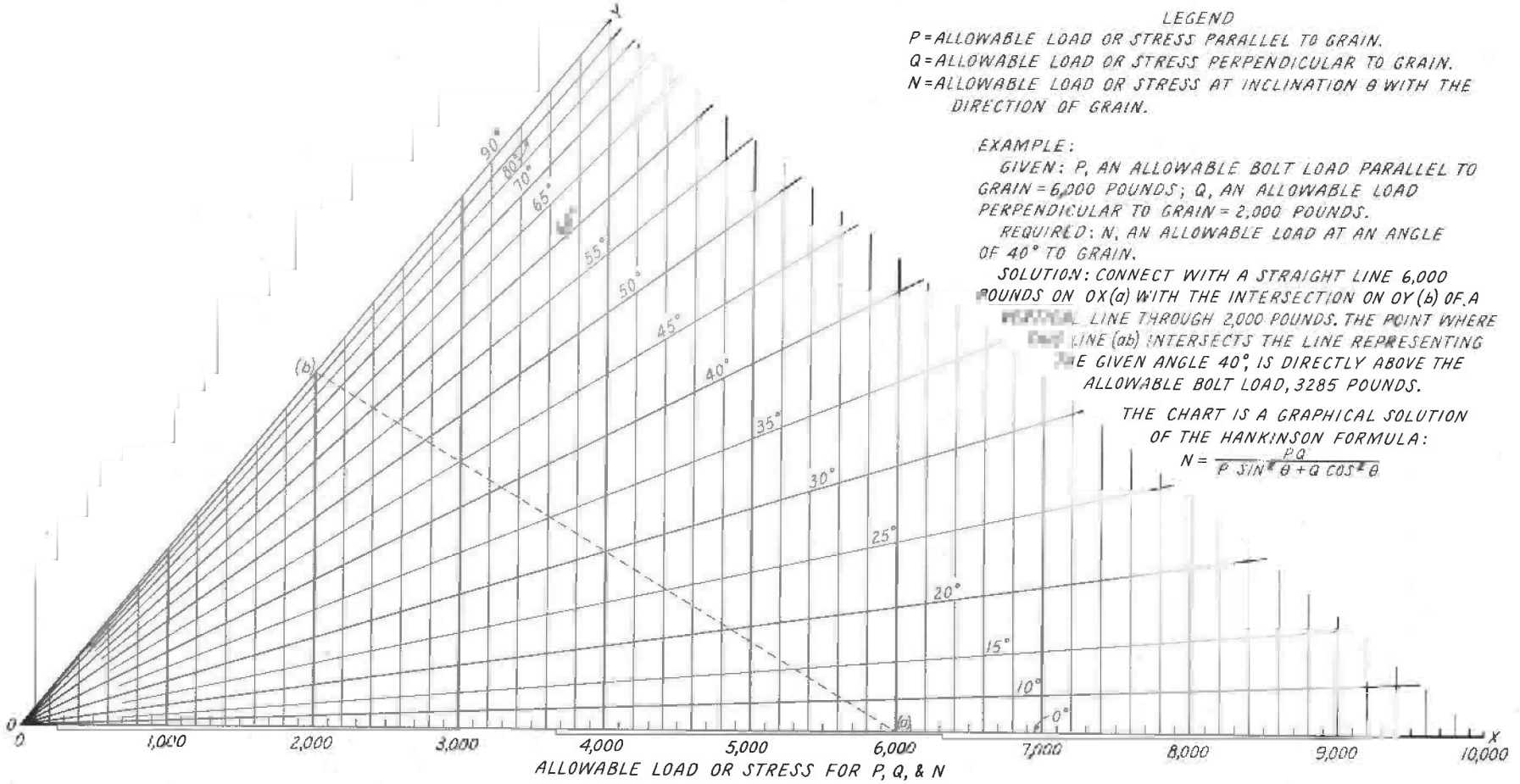
By means of this nomograph the stress or load for any intervening angle can be obtained from the stress or load parallel and perpendicular to the grain without any calculation. The symbols in the chart are represented

---

[1] Original report by J. A. Newlin, Specialist in the Mechanics of Wood, published in Engineering News-Record May 11, 1939.

[2] Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

by allowable loads or stresses, but the formula is applicable for loads or stresses generally. The intercepts on any vertical line are proportional to $\sin^2\theta$ from 0 to 90 degrees. The scale of the chart was chosen primarily for convenient use with bolt loads, but for greater or lesser values or for different units, the magnitude of the scale can be adjusted to obtain greater accuracy without affecting the chart's applicability.



SCHOLTEN NOMOGRAPH FOR DETERMINING BEARING STRENGTH OF WOOD AT VARIOUS ANGLES TO THE GRAIN
(REPRODUCED BY PERMISSION OF THE FOREST PRODUCTS LABORATORY)

Z M 34670 F