

EXPERIMENTAL DETERMINATION OF THE SHEAR AND FLEXURAL STIFFNESSES OF A SANDWICH PANEL

1. INTRODUCTION

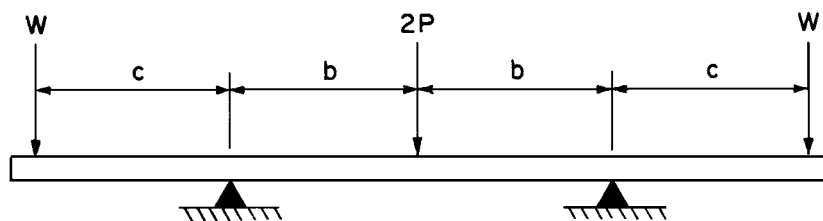
This Data Sheet indicates an experimental method for determining the shear and flexural stiffnesses of a sandwich panel. The method, selected after careful evaluation of the various methods available, tests a specimen strip of sandwich as a simply-supported beam under a five point loading. The deflection due to shear and the deflection due to bending are determined, thus allowing the shear and bending stiffnesses of the sandwich to be evaluated.

2. NOTATION

$2b$	distance between beam supports	m	in
c	distance from beam supports to outer loading points	m	in
D	flexural stiffness of sandwich per unit width of beam	$\text{N m}^2/\text{m}$	$\text{lbf in}^2/\text{in}$
D_q	shear stiffness of sandwich per unit width of beam	N/m	lbf/in
$2P$	load per unit width of beam, applied at centre of beam	N/m	lbf/in
W	load per unit width of beam, applied at each outer loading point	N/m	lbf/in
δ	total deflection of centre of beam with respect to supports	m	in

In the above notation D_q corresponds to either D_{qx} or D_{qy} and D corresponds to D_x or D_y as defined in Data Item No. 68029. Both SI and British units are quoted, but any coherent system of units may be used.

3. THEORY



Sketch 3.1

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The central deflection of a beam under the five point loading shown in Sketch 3.1 is given by

$$\delta = \frac{Pb^3}{3D} - \frac{Wcb^2}{2D} + \frac{Pb}{D_q} \quad (3.1)$$

It follows that, when

$$P = \frac{3cW}{2b} \quad (3.2)$$

$$D_q = \frac{P}{\delta} b. \quad (3.3)$$

Similarly, when $P = 0$,

$$D = -\frac{cWb^2}{\delta} \quad (3.4)$$

The shear and flexural stiffnesses, D_q and D , may therefore be evaluated independently of each other.

4. PROCEDURE

Of the several procedures available with the five point loading system the following is recommended.

A suitable combination of c , b and W is chosen and a load-deflection curve for a complete range of P plotted. This is repeated for several values of the moment cW varied by altering W . A graph similar to that shown in Figure 1 is thereby obtained on which a line satisfying Equation (3.2) is drawn, and its slope, P/δ , evaluated. The value of D_q is then calculated from Equation (3.3).

The values of δ for each value of cW are taken from the intercept of the load-deflection curves and the $P = 0$ line. The quantity (cW/δ) is then evaluated and inserted in Equation (3.4) to yield D .

5. DERIVATION

1. HOWARD, H.B. The five point loading shear stiffness test. *Jl R. aeronaut. Soc.*, Vol. 66, p. 591, September 1962.
2. GRAYLEY, M.E. Shear stiffness of sandwich panels. A review of test methods. *Jl R. aeronaut. Soc.*, Vol. 70, October 1966.