

SANDWICH PANELS WITH CORRUGATED CORE AND EQUAL FACE PLATES. TRANSVERSE SHEAR STIFFNESS

1. NOTATION

D_{qy}	shear stiffness in the yz -plane per unit length, see Item No. 68029	N/m	lbf/in
E	Young's modulus	N/m ²	lbf/in ²
h	depth of core	m	in
p	corrugation pitch	m	in
Q_y	transverse shear load per unit length	N/m	lbf/in
S	shear stiffness factor defined by		
$D_{qy} = S \frac{E}{1 - \nu^2} (h + t) \left[\frac{t_c}{h - t_c} \right]^3 \left[1 + \left\{ 1 - \frac{t_c}{t} \right\} \left\{ \frac{110 - \theta}{100} \right\} \right]$			
t	thickness of each face plate	m	in
t_c	thickness of sheet forming the corrugated core	m	in
θ	angle between face plates and straight diagonal portion of corrugation leg	degree	degree
ν	Poisson's ratio		

Both SI and British units are quoted but any coherent system of units may be used.

2. NOTES

In Figure 1 the shear stiffness factor S is plotted against $p/(h - t_c)$ for various values of θ and h/t_c for symmetrical sandwich panels with corrugated cores.

It is assumed that the centre-line of the corrugation core section consists of straight lines and circular arcs, with bend radius equal to $0.18h$. It is also assumed that the core and face plate materials are the same.

When $t_c/t = 1.0$ and the bend radius is $0.18h$ the values of D_{qy} are exactly those given in the derivation. When t_c/t is in the range 0.6 to 1.25 and the bend radius is in the range $0.12h$ to $0.27h$ the values of D_{qy} from this sheet are within 15 per cent of those given in the derivation.

The shear stiffness of the corrugated panel depends on the nature of the attachments of the core to the face plates – whether by adhesive, rivets or spotwelds. The values given in this Data Sheet are appropriate to a line weld attachment and should be regarded as a guide. If an accurate value for the shear stiffness is required for a particular design, it is recommended that this is obtained from test.

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3. DERIVATION

1. LIBOVE, C. Elastic constants for corrugated core sandwich plates. NACA tech. HUBKA, R.E. Note 2289, 1950.
2. – Initial design of a corrugated core sandwich. Stress Note 48. Handley Page Ltd, October 1957.

4. EXAMPLE

To find the transverse shear stiffness of a corrugated core sandwich panel when

$$t_c = 0.22 \text{ in}, \quad t = 0.028 \text{ in}, \quad h = 0.50 \text{ in}, \quad p = 1.10 \text{ in}, \quad \theta = 70^\circ,$$

$$E = 10.3 \times 10^6 \text{ lbf/in}^2 \text{ and } \nu = 0.3.$$

$$\text{Then} \quad \frac{p}{h - t_c} = 2.29, \quad \frac{t_c}{t} = 0.786 \quad \text{and} \quad \frac{h}{t_c} = 22.7.$$

From Figure 1, with $\theta = 70^\circ$,

$$S = 1.70$$

and

$$\begin{aligned} D_{qy} &= 1.70 \times \frac{10.3 \times 10^6}{(1 - 0.3^2)} (0.50 + 0.028) \left[\frac{0.022}{0.50 - 0.022} \right]^3 \left[1 + \left\{ 1 - \frac{0.022}{0.028} \right\} \left\{ \frac{110 - 70}{100} \right\} \right] \\ &= 1075 \text{ lbf/in.} \end{aligned}$$