

BUCKLING STRESS COEFFICIENTS FOR CURVED PLATES IN SHEAR (CIRCUMFERENTIAL LENGTH EXCEEDING AXIAL LENGTH, EDGES SIMPLY-SUPPORTED)

1. NOTATION

a	axial length of plate	m	in
b	circumferential length of plate	m	in
E	modulus of elasticity of plate material	N/m ²	lbf/in ²
K	buckling stress coefficient defined by $q_b = KE(t/a)^2$		
q_b	shear stress at onset of buckling in plate	N/m ²	lbf/in ²
R	radius of curvature	m	in
t	sheet thickness	m	in

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

2. NOTES

In Figure 1 values of K are plotted for various values of $b/a \geq 1$ against the curvature parameter $a/\sqrt{Rt}$. The curves are based upon theoretical and experimental data.

For plates in which the axial length exceeds the circumferential length see Item No. Struct. 02.03.18.

3. DERIVATION

This section lists selected sources that have assisted in the preparation of this Item. Figures in parentheses give the appropriate references of the British Technical Information Library.

1. CHIARITO, P.T. Some strength tests of stiffened curved sheets loaded in shear. NACA WR No. L4D29 (RDTIC/656), April 1944.
2. MOORE, R.L.
WESCOAT, C. Torsion tests of stiffened cylinders. NACA WR No. 4E31 (RDTIC/682), May 1944.
3. KUHN, P.
LEVIN, L.R. An empirical formula for the critical shear stress of curved sheets. NACA WR No. L5A05 (RDTIC/841), January 1945.
4. RAFEL, N.
SANDLIN, C.W. Effect of normal pressure on the critical compressive and shear stress of curved sheet. NACA WR No. L5B10 (TIL/923(1)), March 1945.
5. BATDORF, S.B. STEIN, M. SCHILDCROUT, M. Critical shear stress of curved rectangular panels. NACA TN 1348, May 1947.

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4. EXAMPLE

It is required to find the buckling shear stress of an aluminium alloy plate when $t = 0.9$ mm, $b = 300$ mm, $a = 200$ mm, $R = 760$ mm and $E = 67\,000$ MN/m².

Then from the geometry $\frac{a}{\sqrt{(Rt)}} = 7.65$ and $\frac{b}{a} = 1.5$.

From Figure 1, $K = 19.1$.

Therefore, $q_b = 19.1 \times 67\,000 \times (0.9/200)^2 = 25.9$ MN/m².