

BUCKLING STRESS COEFFICIENTS FOR SLIGHTLY CURVED PLATES WITH CLAMPED EDGES IN COMPRESSION

1. NOTATION

b	plate width, measured circumferentially	m	in
E	modulus of elasticity of plate material	N/m ²	lbf/in ²
f_b	stress at which plate first buckles	N/m ²	lbf/in ²
K	buckling stress coefficient, defined by $f_b = KE(t/b)^2$		
R	radius of curvature of plate	m	in
t	plate thickness	m	in
δ	maximum initial inward deviation from any generator measured over a length b (see Section 2)	m	in

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

2. NOTES

This Item presents data on buckling stress coefficients for slightly curved plates with clamped edges in compression. The data apply to isotropic plates of uniform curvature with clamped edges and negligible lateral restraint, and long enough to render negligible the influence of any restraint at the loaded edges. In Figure 1 the buckling stress coefficient K is plotted against the non-dimensional parameter b^2/Rt for various values of the ratio δ/t .

One principal factor affecting the buckling stress of curved plates is the depth δ of initial irregularities, and their shape and disposition. The effect of the latter has been partially taken into account by the particular definition adopted for δ , that is the maximum initial inward deviation of the surface of the plate measured from a straight edge of length b placed anywhere on the outside of the plate in an axial plane. Appreciable variation in buckling stress must still be expected for plates having the same δ/t ratio but with differently shaped and differently located initial irregularities.

Buckling stress coefficients have been read from the complete curves of average against edge stress given in Item No. Struct 02.01.11. For the higher values of b^2/Rt , where the average stress is reduced after buckling, the peak values from the curves have been used to calculate K ; for lower values of b^2/Rt (< 20), buckling stresses have been defined as the intersection of the tangent to the curve of average against edge stress immediately after buckling, with the line for average stress equal to edge stress representing conditions before buckling.

The curves from which the buckling stress coefficients are obtained are based on a simplified theory in which certain numerical constants are left undetermined. The constants have been assigned values such that for $b^2/Rt = 0$ the resultant curves agree with those given by existing theory for flat plates, and for $b^2/Rt = 78$ they fit the curves given by theoretical results as closely as possible within the range

considered of most practical importance, see Derivation 1. The intermediate curves have been interpolated.

It may be noted from Derivation 4 that the ascending and descending branches of the load-deflection curve for a perfectly formed curved plate would be tangential to each other, and that therefore the theoretical buckling stress coefficients for $\delta/t = 0$ are not closely approached even for a plate with very small initial irregularities.

3. DERIVATION

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