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Average and edge stresses for thin flat aluminium alloy plates in compression

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AVERAGE AND EDGE STRESSES FOR THIN FLAT ALUMINIUM ALLOY PLATES IN COMPRESSION

1. NOTATION

b	plate width (between rivet lines of plate)	m	in
E	modulus of elasticity of plate material	N/m ²	lbf/in ²
f_a	average stress in plate = $\frac{\text{total load on plate}}{t \times b}$	N/m ²	lbf/in ²
f_e	stress at edges of plate, parallel to direction of applied load	N/m ²	lbf/in ²
t	plate thickness	m	in
ν	Poisson's ratio for plate material		

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

2. NOTES

Figure 1 gives the average plate stress plotted against the edge stress for various ratios of b/t for aluminium alloy plates in compression.

The plates are assumed to be thin ($b/t > 60$) and attached to sturdy stiffeners. The curves are based on the empirically derived equations given in the Derivation with E taken to be 70 000 MN/m² and $\nu = 0.3$. The indicated buckling stress and the slope after buckling correspond to a slight degree of lateral and rotational restraint, see ESDU 72019 and ESDU Struct 02.01.23. Those Items may also be consulted for a more accurate estimate of the buckling stress and of the slope immediately after buckling.

The downward curvature of the post-buckling curve is due to changes in the wave form and, for higher values of f_e , to partial yielding in the plates.

No allowance has been made for the effect of small initial irregularities; this will be small in the post-buckling range but may cause an appreciable rounding of the curve close to the buckling point (see ESDU Struct 02.01.11 to 14).