



ESDU Struct 02.01.09

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Inter-rivet buckling curves for specific materials

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INTER-RIVET BUCKLING CURVES FOR SPECIFIC MATERIALS

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1. NOTATION

E	Young's modulus of sheet material in compression	N/m ²	lbf/in ²
E_t	tangent modulus of sheet material in compression at stress f_e	N/m ²	lbf/in ²
f_e	edge stress at which sheet buckles between rivets	N/m ²	lbf/in ²
f_n	stress at which $E_t = \frac{1}{2}E$ (see ESDU 76016*)	N/m ²	lbf/in ²
K	fixity coefficient at rivets		
l	rivet pitch	m	in
m	material characteristic (see ESDU 76016*)		
t	sheet thickness	m	in

* ESDU 76016 "Generalisation of smooth continuous stress-strain curves for metallic materials".

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

2. NOTES

The method of drawing curves of the inter-rivet buckling stress f_e against l/t for specific materials, using ESDU Struct 02.01.08 is illustrated. Auxiliary scales allow f_e to be read directly against l for standard sheet gauges.

The assumptions and conditions under which the curves are valid are given in ESDU Struct 02.01.08.

The example curves have been drawn for a fixity coefficient at the rivet, $K = 3$ (which is appropriate to snaphead riveting), for three commonly used aluminium alloys. The curve for B.S. L150, for example, was drawn as follows.

From ESDU 76016, the relevant properties of B.S. L150 (previously B.S. 2L71) material are $E = 72\,400\text{ MN/m}^2$, $m = 16$ and $f_n = 339\text{ MN/m}^2$, so that

$$\left(\frac{f_n}{KE}\right)^{1/2} = \left(\frac{339}{3 \times 72\,400}\right)^{1/2} = 0.0395.$$

Then for $l/t = 10$, following the arrowed line on ESDU Struct. 02.01.08, $f_e/f_n = 1.10$, and $f_e = 1.10 \times 339 = 373\text{ MN/m}^2$. The curve is completed by a repetition of this process for other values of l/t .

The curve has been terminated at the 0.5 per cent proof stress in compression because, as explained in ESDU 76016, the value of m is calculated to apply only up to this stress.

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