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Buckling in compression of sheet between rivets

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BUCKLING IN COMPRESSION OF SHEET BETWEEN RIVETS

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BUCKLING IN COMPRESSION OF SHEET BETWEEN RIVETS

1. NOTATION

E	modulus of elasticity 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

In Figure 1 the ratio f_e/f_n is plotted against $(l/t)(f_n/KE)^{1/2}$ for a range of values of m . The auxiliary right-hand scale marked $(f_n/KE)^{1/2}$ and the straight lines marked l/t are added for convenience in computation and enable f_e/f_n to be read directly against l/t . ESDU 90002[†] provides a computer program that may be used to calculate f_e from the sheet material properties and l , K and t directly.

The curves may be used to find the inter-rivet buckling stress of a sheet directly and may also be used to draw curves of buckling stress against l/t for specific materials. Such curves are given in ESDU Struct 02.01.09.

The stress f_e refers to the edge stress in the sheet at the rivet line and may be regarded as the limiting compressive stress to which the sheet between the rivets can be subjected.

Values of f_n and m for certain materials are given in ESDU 76016* or they may be calculated using the methods given in that Item. Edge stresses for thin flat plates may be found from ESDU Struct 02.01.02 and ESDU Struct 02.01.03.

The fixity coefficient at the rivets, K , depends on methods of fabrication and type of rivets or other attachments. However, limited test data indicate that for conventional methods of attachment values of the order of those given in the following table are appropriate.

[†] ESDU 90002 "Struts: strength under flexural, local and inter-rivet buckling".

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