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Nomogram for strength of stringers in panel in compression

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NOMOGRAM FOR STRENGTH OF STRINGERS IN PANEL IN COMPRESSION

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NOMOGRAM FOR STRENGTH OF STRINGERS IN PANEL IN COMPRESSION

1. NOTATION

A_s	area of section of stringer	m ²	in ²
b	plate width between stringers, measured as distance between adjacent rivet lines	m	in
E_{edge}	tangent modulus of stringer material at stress f_{edge}	N/m ²	lbf/in ²
E_s	tangent modulus of stringer material at stress f_s	N/m ²	lbf/in ²
f_b	stress at which plate first buckles in compression, deduced from ESDU 72019*	N/m ²	lbf/in ²
f_{edge}	edge stress at failure of stiffened panel	N/m ²	lbf/in ²
f_s	failing stress of stringer alone, constrained to fail by flexure in direction normal to sheet	N/m ²	lbf/in ²
I_s	second moment of area of stringer section about axis through stringer centroid parallel to sheet	m ⁴	in ⁴
I_x	second moment of area of stringer section about axis in median plane of sheet	m ⁴	in ⁴
t	sheet thickness	m	in

* ESDU 72019 "Buckling of flat isotropic plates under uniaxial and biaxial loading".

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

2. NOTES

Figure 1 provides a nomogram for calculating the failing edge stress of stiffened panels and represents the formula of ESDU Struct 02.01.16 (see Section 3) using the $f_{average}/f_{edge}$ relation corresponding to the conditions of ESDU Struct 02.01.03[†], but without the particular approximations introduced in ESDU Struct 02.01.16 that were necessary for the presentation of data in that form.

The procedure to be followed in using the nomogram is as follows.

- (1) Calculate for the panel I_s , I_x , f_s , $A_s/(bt)$ and f_b .
- (2) Assume $f_{edge} = f_s$. Draw a straight line from the given value of I_x/I_s to the point of intersection of the $A_s/(bt)$ curve with the estimated f_b/f_{edge} curve.

[†] ESDU Struct 02.01.03 "Average and edge stresses for thin flat aluminium alloy plates in compression".