LIFT COEFFICIENT INCREMENT DUE TO FULL-SPAN DOUBLE FLAP (MAIN FLAP SLOTTED)

See Item No. 97002 for introduction to Items on high-lift devices.

1. NOTATION AND UNITS (see sketch in Figure 1)

		SI	*British*
A	aspect ratio		
a	slope of lift curve of wing of aspect ratio A	rad^{-1}	rad^{-1}
a_6	slope of lift curve of rectangular wing of aspect ratio 6	rad^{-1}	rad^{-1}
C_{LN}	lift coefficient of wing at chosen incidence with main and auxiliary flaps in neutral position		
ΔC_L	lift coefficient increment due to full-span double flap, with wing at chosen incidence, based on wing chord and aspect ratio of wing, $\Delta C_L = \Delta C'_{LT}\left(\frac{c'}{c}\frac{a}{a_6}\right) + C_{LN}\left(\frac{c'}{c} - 1\right)$		
$\Delta C'_L$	lift coefficient increment due to full-span main flap with $\delta_{fA} = 0$ based on extended wing chord and aspect ratio 6 (see Item No. Aero F.01.01.08)		
$\Delta C'_{LA}$	lift coefficient increment due to full-span auxiliary flap, based on extended wing chord and aspect ratio 6		
$\Delta C'_{LT}$	lift coefficient increment due to full-span double flap, $\Delta C'_{LT} = \Delta C'_L + \Delta C'_{LA}$		
c	wing chord	m	ft
c_f	flap chord with double flap in neutral position	m	ft
c_{fA}	chord of auxiliary flap with double flap in neutral position	m	ft
c'	extended wing chord	m	ft
δ_f	flap angle of main flap, *i.e.* rotation of main flap from neutral position	deg	deg
δ_{fA}	flap angle of auxiliary flap, *i.e.* rotation of auxiliary flap with respect to chord of main flap	deg	deg

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2. NOTES

This Item is superseded by Item No. 95021 (Reference 9) but is temporarily retained because it is cross-referenced in other Items. However, Item No. 95021 should now always be used to calculate the flap lift increment.

The lift coefficient increment $\Delta C'_{LA}$ is plotted against δ_{fA} for various values of the ratio c_{fA}/c'. In order to determine the lift coefficient increment due to a double flap the contributions of the main flap and the auxiliary flap are estimated separately and summed, using the dashed curves in Figure 1 of Item No. Aero F.01.01.08 (Derivation 2) for the lift coefficient increment due to the main flap and the curves in Figure 1 of this Item for the contribution of the auxiliary flap.

When estimating the lift coefficient increments of the two components of the double flap separately it should be noted that in both cases the increments must be based on the same value of the extended wing chord.

The extended wing chord is obtained as follows: first, the auxiliary flap is rotated from its deflected position about the point of intersection of the auxiliary flap chord with the chord of the main flap until the two chords coincide, then both flaps are rotated from the deflected position of the main flap about the point of intersection of the main flap chord with the wing chord until these two coincide. The distance from the leading edge of the wing to the trailing edge thus obtained is defined as the extended wing chord.

The data are applicable to slotted or split auxiliary flaps with the deflection of the main flap not less than about 10 degrees.

It is assumed that the flaps are of good design and the slot shapes are optimum for the required deflections.

For a part-span double flap or for the effect of taper of the planform of the wing the factors given in Item No. 74012 (Reference 8) may be applied, see Example.

This Item does not apply to flaps having in themselves a fixed slot or some similar arrangement (see Derivation and References).

3. DERIVATION AND REFERENCES

3.1 Derivation

The Derivation lists selected sources of information that have assisted in the preparation of this Item.

1. YOUNG, A.D — The aerodynamic characteristics of flaps. ARC R & M 2622, 1953.

2. ESDU — Lift coefficient increment due to full-span slotted flaps. ESDU International, Item No. Aero F.01.01.08, 1949

3.2 References

The References are sources of information supplementary to that in this Item.

3. HARRIS, T.A
RECANT, I.G. — Wind-tunnel investigations of NACA 23012, 23021 and 23030 airfoils equipped with 40 per cent chord double slotted flaps. NACA Rep. 723, 1941.

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