



Approximate estimation of braking thrust of propellers (piston engines)

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THE PREPARATION OF THIS DATA ITEM

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APPROXIMATE ESTIMATION OF BRAKING THRUST OF PROPELLERS (PISTON ENGINES)

1. NOTATION AND UNITS

AF	activity factor per blade = $\frac{10^5}{D^5} \int_{0.1D}^{0.5D} cr^3 dr$	–
	(where c is the propeller blade chord in ft at a distance r ft from the axis)	–
C_{P_0}	power coefficient in static condition = $550 P_0 / (\rho n_0^3 D^5)$	–
C_{T_0}	thrust coefficient in static condition = $T_0 / (\rho n_0^2 D^4)$	–
D	propeller diameter	ft
n_0	propeller rotational speed in static condition	rps
P_0	engine shaft power in static condition for landing brake operation	hp
T	thrust	lbf
T_0	thrust in static condition for landing brake operation	lbf
TAF	total activity factor (= $AF \times$ number of blades)	–
V	aircraft forward speed	kn
$\theta_{0.7}$	blade angle at 0.7 of total propeller radius	degree
ρ	air density	slug/ft ³

2. NOTES

The Data Item gives a simplified method for the estimation of the braking thrust of propellers with piston engines. It must be emphasised that the curves are approximate. The method should be used only for a first estimate.

Figures 1 and 2 give the power and thrust coefficients under static conditions in terms of blade angle and total activity factor. The activity factor is a function of blade planform; if the activity factor is unknown a guide to suitable values for single blades will be found in ESDU PERF ED 1/1, Reference 1.

Figure 3 gives the variation of T/T_0 with forward speed.

The method of using this Item is illustrated in the example. It is necessary first to know the engine power and rpm, rating to be used for landing brake operation, and the forward speed, propeller diameter and, if possible, total activity factor. With piston engines the maximum power rating for this type of operation is usually determined by cylinder head temperature; approval is often not granted for use of powers in excess of maximum continuous or maximum weak mixture ratings.

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