# ENGINE ANALYSIS No. 101

# COX TEE DEE ·049

## High performance glow plug engine for contest flying in the ½A F/F class

by
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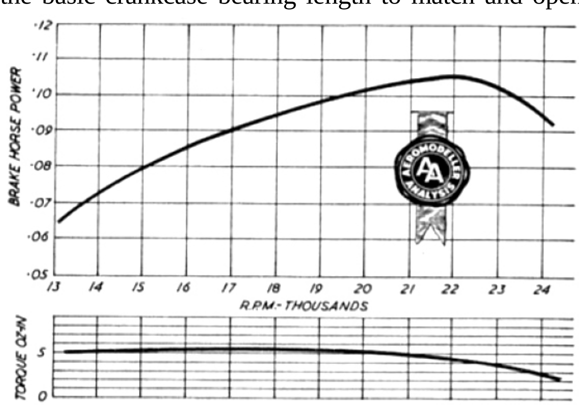
THE DEE-DEE is an exactly scaled down version of the T-D .15 in the ratio 1:1.44, reducing the bore from .585 in. to .406 in. and the swept volume from .1494 cu. in. to .0499 .cu. in. (0.819 c.c.) or the upper limit of the American ½ A contest size. Like its larger counterpart it is essentially an engine with contest performance which gives it certain characteristics not normally associated with sports motors for "Sunday flying." Nevertheless it is still an easy motor to handle, particularly using spring start, and can be "tamed" by using larger propeller sizes, if necessary.

### Hot fuel advised

For absolute maximum performance very high nitro-content fuels can be used, provided one accepts the fact that above 40 per cent. nitromethane content glow element life will be drastically reduced. Also the compression ratio is extremely high to start with. For all practical purposes a 30 per dent. nitromethane fuel is about the hottest fully compatible with the design layout. The test figures were obtained on a nominal 25 per cent. nitromethane mixture (nominal because the original mixture was re-made around a commercial nitro fuel, the actual nitro percentage of which was suspect on comparing running figures). These showed a peak B.H.P. figure of .105 at 22,000 r.p.m., equivalent to nearly .13 B.H.P. per c.c., which is really top performance for a glow motor of any size.

The .049 is adaptable to pressurization via the tapping point on the crankcase plastic moulding, drilling through the basic crankcase bearing length to match and open up a port "timed" by the crankshaft induction port. It is very difficult to assess the merits of pressurization on bench-run tests. Certainly it did not make any measurable difference on propeller-r.p.m. figures. Under flight conditions, however, pressurisation might make all the difference between a good consistent run and one plagued by varying feed due to tank position, inertia forces, etc.




### Pressure feed not essential

If flight performance is consistent without pressurisation, it would seem best to forget it. If flight running is inconsistent, we would still prefer try altering tank position, shape, etc., first before resorting to pressurisation. One thing about tapping the pressure point off the crankshaft, though, is that it does make it non-critical and with no adverse effect on starting characteristics.

The .049 ran consistently at all propeller-speeds tried, which ranges from about 12,000 r.p.m. up to beyond 21,000 r.p.m. on 5 in. diameter propellers. It is obviously happiest running at the higher speeds—as well as peaking very high in the speed range—so that a 6 x 3 propeller would appear a logical free flight choice, with a 5½ x 4 or 5 x 4 for control line. Hand starting is still readily possible with 5 in. diameter propellers although because of the high compression timing is very "advanced" and there is a considerable kick-back. Propellers must be flipped really smartly. using the spring starter gives far less trouble, safer to the fingers, and pretty foolproof unless the engine is flooded.

### Strong props wanted

Nylon or wooden propellers are virtually essential for safety—with the .049 seeming to prefer the additional "flywheel" effect of the heavier plastic product. Brittle plastic propellers (e. g. styrene) could well burst or shed a blade at these speeds. Because running speeds are high, too, propellers require careful balancing to minimise vibration—and a final adjustment of position on the shaft to give the smoothest possible running. The beam mounting lugs give a more solid fixing than the plastic mounts used on the two smaller engines—and also represent a change in appearance on the two larger Tee-Dee engines (.049 and .15).

In layout and construction the .049 follows that of the .15 (see AEROMODELLER January 1962), with all components proportionately reduced in size. Crankshaft diameter is a generous .280 in. with bearing surface relieved to provide two main journals (one long and one short). The crank web is counterbalanced to a fair degree. The whole shaft is quite hard and finished by grinding over the journals and .109 in. diameter crankpin.

The cylinder is of unhardened steel with the same fluted diametrically opposed transfer passages as on all the Tee-Dee series. The piston is hardened, with ball-and-socket little end joint for the slightly tapered hardened steel connecting rod of .807 in. mean diameter. The light alloy crankcase unit is machined from bars stock tapped to take a front collar locating the plastic moulding comprising the centre section and venture base. The venturi then screws into the plastic housing through the carburettor fitting (comprising needle housing and main jet feeding the groove in the venture body opening into the throat via four peripheral jets. These jet holes are small and readily clogged—hence the advisability of using clean, preferably filtered fuel. Cox do, in fact, make a filter-spout to fit standard fuel cans and for the protection it gives this simple device is an excellent fitting for any fuel can.

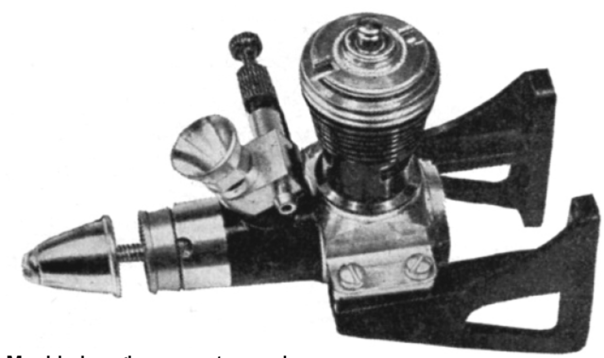
Needle Adjustment tended to be a little bit critical on straight fuel, although starting was still straightforward and running consistent. For consistent contest performance it will probably be necessary to formulate an "optimum" mixture to suit average conditions and then be prepared to adjust the fuel proportions, as necessary, to meeting changing climatic conditions. With a head element there is no chance to change the glow plug for a "hotter" or "cooler" type.

**Ready for use**

With the Cox standard of manufacturing accuracy, surface finish and fits, no running-in is necessary with the .049 although the initial run should be made on a rich mixture just as a precaution. As with the two smaller engines, "lacquering" may develop later to retard performance and require removing (on LeRoy Cox's advice) by scouring the cylinder bore with fine steel wool. There is little or no chance of reworking the engine to get any little extra performance, nor is this necessary (no modification is likely to improve performance in this highly developed design).

Maximum performance with a new engine will be developed after only a few minutes running time—say 30 minutes at the most—and the possibility of variation between different engines is remote. Any marked differences in the performance of two new engines can be put down to fuel differences. Some loss of performance after about an hour's running may be noticed, recoverable by "de-lacquering". Unlike some glow motors, too, performance should be held for quite a long useful life.

Although a perfectly normal production engine—every one the same and produced in thousands—the .049 is up to top contest standard in ½-A class—better than most of its contemporaries and comparable with most "tuned" specials (and without being as tricky or sensitive to fuel mixture as some). It looks right, sounds right on "matching" propeller sizes, and backs up that promise with a peak B.H.P. figure comparable with that of many 1 c.c. diesels. It is not the easiest of .049 glow motors to start, but that is a small price to pay for the performance achieved.



Moulded engine mounts, made by L. M. Cox for the Tee Dee .049 convert it to a firewall radial mounting as seen in above view

**Material Specifications:**

Crankcase: machine from light alloy bar stock
Intake housing: injection moulded plastic
Cylinder: mild steel (integral fins)
Cylinder head: turned from light alloy (integral glow element)
Back cover: machined from solid.
Crankshaft: hardened steel
Connecting rods: hardened steel (machined). Ball and socket little end
Piston: hardened steel (hardened on walls only), flat top
Propeller shaft: steel screw and spinner (turned from light alloy)
Venturi intake: machined from light alloy
Carburettor collar: light alloy (anodised gold).
Needle: steel (spring ratchet)
Propeller driver: machined from light alloy (anodised gold).
*Manufacturers:* L. M. Cox Manufacturing Co., Box 476 Santa Ana, California, U.S.A.
U.S. Retail Price: $7.98. Price in G.B. 77s. 6d.
British importers: A. A. Hales Ltd., Potters Bar, Middlesex.

**Specification**

Displacement: .819 c.c. (.0499 cu. in.)
Bore: .406 in.
Stroke: .386 in.
Bore/stroke ratio: 1.05
Bare weight: 1⅛ ounces
Max power: .105 B.H.P. at 22,000 r.p.m.
Max. torque: 5.5 ounce-inches at 18,000 r.p.m.
Power rating: .128 B.H.P. per c.c.
Power/weight ratio: .07 B.H.P. per ounce

**Propeller R.P.M. Figures**

| *Propeller* | *R.P.M.* |
|---|---|
| 6 x 4 Top Flite nylon | 14,500 |
| 5½ x 3 Top Flite nylon | 21,000 |
| 6 x 3 Top Flite nylon | 18,400 |
| 5½ x 4 Top Flite nylon | 18,200 |
| 6 x 4 Davies-Charlton nylon | 17,000 |
| 5½ x 3½ Davies-Charlton nylon | 24,000 |
| 6 x 4 Frog nylon | 15,400 |
| 6 x 4 Stant | 12,200 |
| 6 x 3 Stant | 14,400 |
| 5 x 3 Keilkraft nylon | 21,000 |
| 5 x 4 Keilkraft nylon | 19,800 |

*Fuel:* 25 per cent. nitromethane, 20 per cent castor; 55 per cent. methanol.