THE Cox is a remarkable species of engine. Having arrived at a design layout which lends itself to exact scaling up or down to produce a whole family of sizes, each specific size then seems to lend itself to further minor variations, reflected in an appreciable difference in performance. Virtually, in fact, you get what you pay for. The more expensive the model in any particular size, the more powerful it is. Just where the extra comes from is difficult to detect, for workmanship throughout the range is outstanding.

The Cox Special 15 replaces the Tee Dee 15 (see AEROMODELLER, January 1962), which itself was an engine of outstanding performance for its size and weight, but suffered on the initial production run, at least, in having a cylinder with too thin a wall. As a result the cylinder was prone to crack between the exhaust ports, in line with the bottom of the ports. This was rectified by increasing the cylinder wall thickness quite substantially.

Despite its high speed performance, and a peak B.H.P. figure well in excess of 0.4 on heavily nitrated fuels, the Tee Dee 15 did not receive the contest honours one could have anticipated (particularly in the free flight field), which position the Special 15 looks like rectifying. It has already proved itself an outstanding unit at the U.S.A. 1963 F.A.I. power team eliminations. Although basically the same as the original Tee Dee it does give the impression of being a more rugged and contestworthy engine, to say nothing of having found some additional power. The only major change, in fact, is the abandonment of a ball-and-socket con rod/piston assembly in favour of a more conventional gudgeon pin fitting. In other details, the comments of our rod/piston assembly in favour of a more conventional change, in fact, is the abandonment of a ball-and-socket con

The Cox Special 15 is an out-and-out high speed engine. It is not happy on the larger propeller sizes, and even at 12,000 r.p.m. load-speed displays a certain reluctance to settle down. Starting characteristics, too, deteriorate at these lower speeds. But let it wind up to 17-20,000 r.p.m. with an 8- or 7-inch low pitch propeller and it becomes one of the sweetest running engines you could wish for, not particularly critical on settings and almost instant flick-starting, following a prime. About the only critical feature as regards handling is the fuel tank level for starting. Suction lift is relatively low when flicking over and the best tank position is just below the level of the spraybar. Gravity feed is not to be recommended as it makes it all too easy to flood the engine, especially if the battery is not right up to scratch.

Performance is noticeably improved running on high-nitro fuels and 30 per cent. nitro seems about the best selection for normal free flight contest work. Although shortage of nitromethane in this country has led to the virtual disappearance of commercial high-nitro fuels, Cox racing glow fuel (30 per cent. nitro) is now available in Britain-and at quite a reasonable price for this type of fuel, too-and it is an ideal match. Performance is still good on standard Cox fuel (15 per cent. nitro), but definitely down (and high speed running less consistent) on straight fuels. Starting characteristics also deteriorate on straight fuels, although the compression ratio is high enough for running on non-nitrated fuels.

A 30 per cent. nitro fuel also gives a reasonable element life with the standard glow head. A new "long life" head has recently been introduced to fit the "15" (and also in other sizes for the 09 and 049), the only differences being that the element wire appears to be slightly thicker, and the actual machined surface of the combustion chamber slightly rougher (i.e. not polished as in the standard Special head). We noticed no difference in performance at all at low to moderate load-speeds (which in the case of the Special ranges up to some 15,000 r.p.m.) but at higher speeds the normal head was worth several hundred extra r.p.m. Whether this was a characteristic of just the samples tried or not we cannot judge. Certainly, however, the "long life" element is much more robust and will stand up to a 2 volt accumulator for starting-provided the leads are not left on too long and the ac. is of reasonably small size so that the terminal voltage is pulled down a bit under load.

Performance we found to be quite markedly affected by weather. Initial runs in very cold conditions were somewhat disappointing, but subsequent runs in a higher ambient temperature produced outstanding results. By this time, too, the engine had received some 11/2 hours running and although Cox engines are noted for their accuracy and are never "tight" even when new, performance does improve with about an hour's running time. The manufacturer's also make a special mention of "shellacing" or the formation of varnish-like deposits which can build up on the walls of the cylinder and contribute high frictional drag, although there was no evidence of this in our handling time, using Cox fuel throughout. The only time we experienced marked loss of power was in very cold weather, or when the cylinder has become accidentally unscrewed. It is relatively easy to loosen the cylinder
Specification

Displacement 2.49 cc (.1494 cu. in.)
Bore: .591 in.
Stroke: .556 in.
Weight: 41.2 ounces
Max. power: 46 B.H.P. at 18,000 r.p.m.
Max. torque: 32 ounce-inches at 12,000 r.p.m.
Power rating: .185 B.H.P. per c.c.
Power/weight ratio: .102 B.H.P. per ounce
Max. power: .46 B.H.P. at 18,000 r.p.m.
Weight: 4½ ounces
Stroke: .556 in.
Bore: .591 in.
Displacement: 2.449 c.c. (.1494 cu. in.)

Crankshaft: hardened steel 1/16 in. diameter
Connecting rod: machined from light alloy (plain big- and little-ends)
Piston: cast iron special alloy
Propeller shaft: .161 in. N.S.F. steel
Propeller collar: light alloy (anodised gold)
Needle: steel (spring ratchet)
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

When removing the head soon after a run for instance, as the head-cylinder fit is very tight, due to the greater expansion of the aluminum head when hot.

Test figures showed the remarkably high r.p.m. of 16,700 to 17,500 on 8 x 4 propellers, which appears a logical free flight size. A typical 9 x 4 pulls the revs. down quite a bit, but a 9 x 3 would also seem a good choice. Peak power, as determined from the dynamometer test, was developed at 18,000 r.p.m. although with smaller loads speeds well over 20,000 r.p.m. could be attained and held with remarkable steadiness. For a plain bearing engine this is a most remarkable performance. The only "fussy" characteristics we found, apart from fuel tank level for easy starting, was that the Special, like all Cox engines, readily suffers a blocked jet if the fuel is at all dirty. Clean fuel - and was that the Special, like all Cox engines, readily suffers a "smoothed" by the shaft! To drill for pressurisation demands a complete disassembly job.

This also raises another important point. Modellers used to rugged diesels and apt to use more than a reasonable amount of brute force on disassembling motors. Although the Cox is not a weak engine by any means, it must be handled with extreme care when taking apart and putting together, and only using the combination tool provided in the proper manner. The cylinder is quite soft and readily damaged if mishandled.

Constructionally the Special features the now familiar Cox layout, with virtually all metal parts turned from bar stock on automatic machines and produced to very close tolerances. The same 7/16 in. o/d crankshaft as on the Tee Dee 15 is retained with the large 7/16 in. by .290 in. port tolerances. The same 7/16 in. o/d crankshaft as on the Tee Dee 15 had a hardened piston and ball and socket little end.

To make use of this facility the underlying metal must be drilled through to open up a hole which is then "timed" by the crankshaft port. We have heard of people doing this with the shaft in situ (rotating the shaft into a position where the drill enters the port), but this is hardly to be recommended in view of the burr which could be produced on the inside, leaving this to be fixed. To drill for pressurisation demands a complete disassembly job.

Summarising, we can only again rate the Cox Special as an outstanding example of precision production engineering with an exceptional performance, rendered even more remarkable in terms of power/weight ratio. It is not everybody's engine in that it is essentially intended as a high speed unit and it will give a disappointing performance if used with large props. It is also not as easy to start as a sports type glow motor, and is vicious on mistakes or carelessness flicking over with a 7-inch prop.


Material specification

Power/weight ratio: .102 B.H.P. per ounce
Power rating: .185 B.H.P. per c.c.
Max. power: .46 B.H.P. at 18,000 r.p.m.
Weight: 4½ ounces
Stroke: .556 in.
Bore: .591 in.
Displacement: 2.449 c.c. (.1494 cu. in.)

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The piston on the Special, incidentally, is also unhardened and incorporates a floating gudgeon pin on which are located two tightly fitting spacers to position the con. rod centrally. Another detail feature is that the top edge of the piston is quite generously radiused off.

The Tee Dee 15 had a hardened piston and ball and socket little end.

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Compared with a diesel, too, it will undoubtedly have a limited life-but prop. for prop. it will out-rev any other engine of its size we know over its optimum speed range. It would appear to have outstanding potential as a contest engine.

R.P.M. Figures

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<th>R.P.M.</th>
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**Table of Performance Figures**

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**Propeller**

8 x 4 Top Flite 13,500
9 x 4 Top Flite 15,300
8 x 4 Top Flite 16,300
9 x 4 Top Flite 16,700
8 x 4 Top Flite 16,700
9 x 4 Top Flite 17,500
8 x 4 Top Flite 18,000
9 x 4 Top Flite 20,000

**Fuel used**

Cox Racing glow fuel (30 per cent. nitromethane).