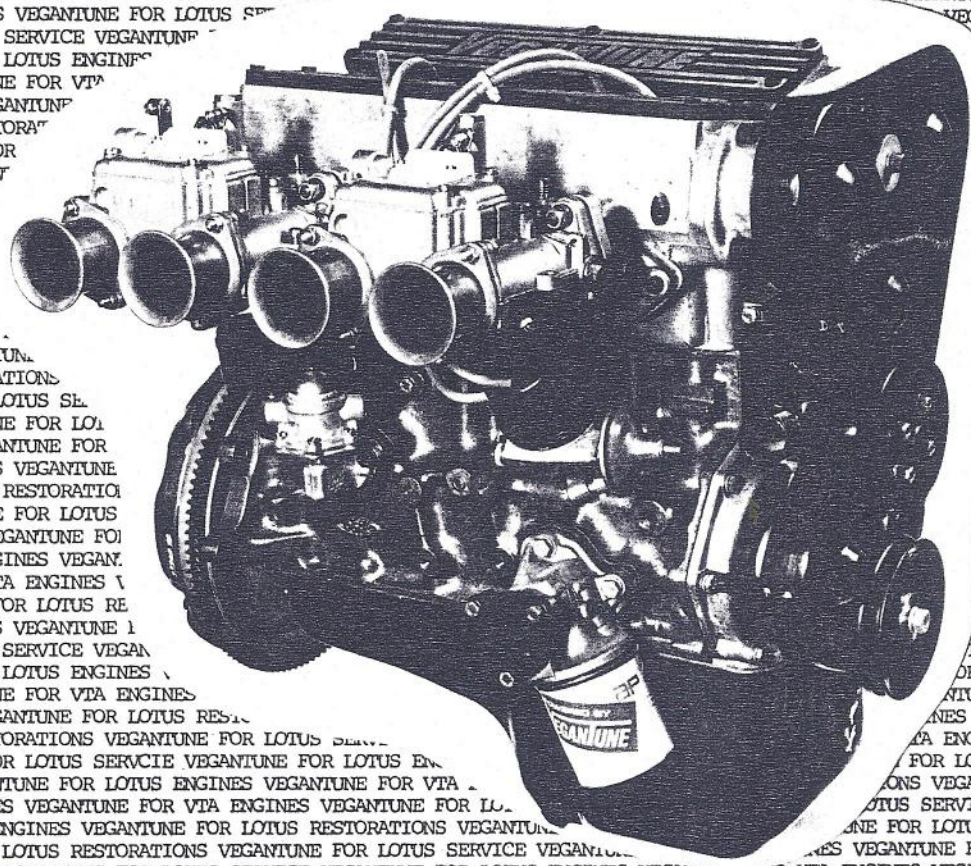


# VEGANTUNE

## THE VTA RACING ENGINES



**CRADOCK BANK  
SPALDING  
INC'S  
TEL: (0745) 4846**

# VEGANTUNE

## THE VEGANTUNE VTA RANGE OF ENGINES

VEGANTUNE HAVE DESIGNED, DEVELOPED AND MANUFACTURED THE VTA ENGINE AS A DIRECT REPLACEMENT FOR THE LOTUS TWIN CAM ENGINE IN THE CATERHAM 7, LOTUS ELAN & +2.

THE VTA IS ALSO A REPLACEMENT UNIT FOR LOTUS/FORD TWIN CAM AND THE FORD KENT RANGE OF ENGINES. STANDARD AND MODIFIED UNITS ARE AVAILABLE ALSO CONVERSION KITS.

THE VTA HAS BEEN DESIGNED TO GIVE A HIGH POWER OUTPUT AND GOOD TORQUE, (130BHP IN STANDARD FORM) WITH EXCELLENT FUEL ECONOMY.

THE VTA HAS AN ALUMINIUM CYLINDER HEAD WITH REMOVABLE ALUMINIUM CAM CARRIERS, BELT DRIVEN CAMS AND JACKSHAFT, EMPLOYING THE WELL TRIED AND PROVEN HEMI-SPHERICAL COMBUSTION CHAMBERS WITH TWO VALVES PER CYLINDER. THE VALVE GEAR HAS BEEN DESIGNED TO HAVE LOW NOISE LEVELS AND TO EXTEND THE PERIOD BETWEEN VALVE AND TAPPET SERVICING. SPECIAL ATTENTION HAS BEEN GIVEN TO OIL DRAINAGE FROM THE VALVE TRAIN, VALVE STEM OIL SEALS ARE FITTED AND IMPROVED COOLING AROUND THE EXHAUST VALVE SEAT AREA TO EXTEND EXHAUST VALVE LIFE.

THE INLET MANIFOLD IS DETACHABLE ALLOWING EITHER VERTICAL OR HORIZONTAL CARBURETTORS TO BE USED, THIS ALSO MAKES DISTRIBUTOR SERVICING MUCH EASIER.

THE WATER PUMP IS A THREE BOLT FITTING, WHICH IS EASILY REPLACED SHOULD THERE BE ANY NECESSITY.

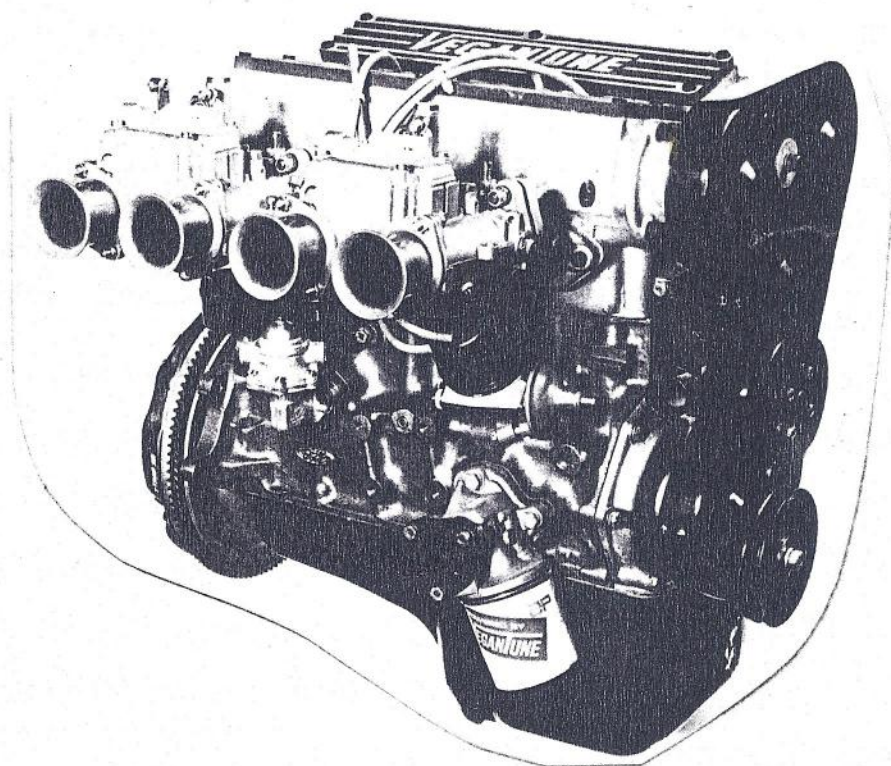
UNIT AND CONVERSION KITS ARE AVAILABLE FOR THE FORD PUSHROD IN LINE FOURS FROM THE OLD 105E, TO THE PRESENT CROSS FLOW KENT UNITS, COVERING CAPACITIES FROM 997CC TO 1600CC.

COST EX WORKS:

CONVERSION KITS FROM £966.38

COMPLETE ENGINES £1399.00

MODIFIED UNITS ALSO AVAILABLE



NOTE

ALL PRICES EXCLUSIVE OF VAT AT CURRENT RATE

# VEGANTUNE

ENGINE PERFORMANCE TEST  
ON SUPPLYFLOW OF 6000

DATE 6/7/82 TEST NO. 8219

ENGINE STD VTA 1600CL

TEST DESCRIPTION \_\_\_\_\_

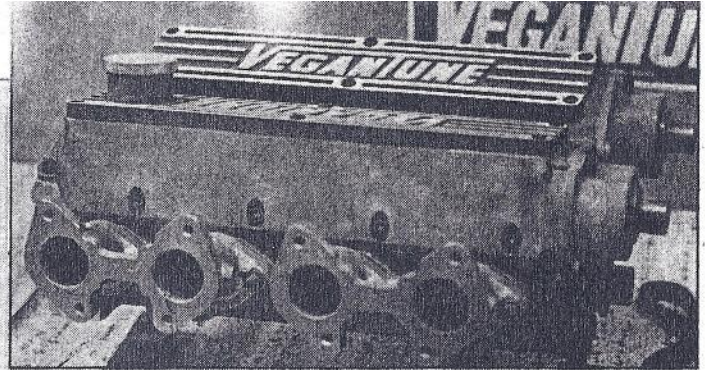
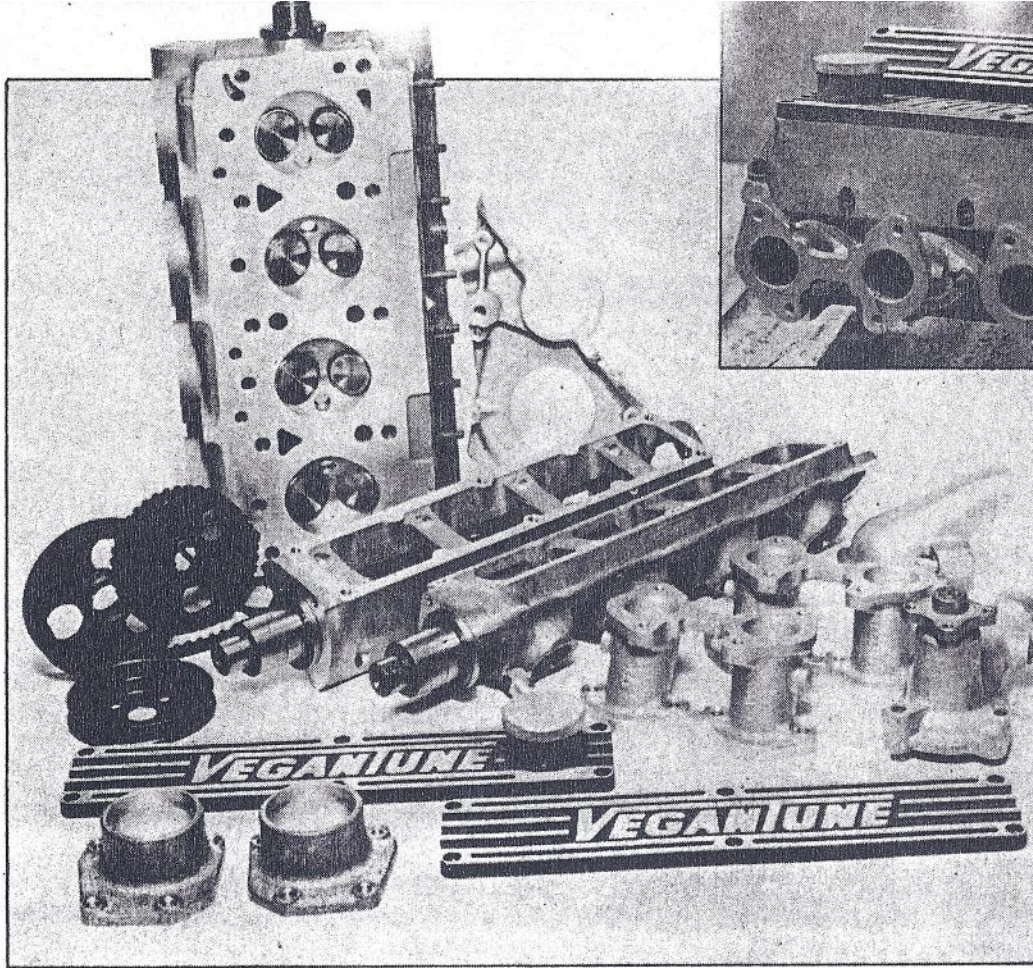
TEST DATA

*P. Peltus*

NRH	T	IP	FM	FD	MI	ME	A/T	BS/C
	LD/FT		LD/FT		LD/FT		LD/FT	
3000	70	01	3	27	0	0	0.0	0.32
3000	60	03	3	25	0	0	0.0	0.33
3000	70	01	2	30	0	0	0.0	0.34
3100	100	11	2	31	0	0	0.0	0.44
4000	100	12	2	34	0	0	0.0	0.44
4200	107	07	3	42	0	0	0.0	0.45
4300	111	70	3	44	0	0	0.0	0.45
4700	111	101	3	45	0	0	0.0	0.45
5000	113	100	2	50	0	0	0.0	0.45
5000	113	110	7	50	0	0	0.0	0.45
5000	113	117	11	01	0	0	0.0	0.42
5700	113	124	2	04	0	0	0.0	0.50
6000	113	127	0	05	0	0	0.0	0.42
6200	111	133	3	06	0	0	0.0	0.47
6300	100	131	3	05	0	0	0.0	0.41

EXHAUST TEMPERATURE

CYL1	CYL2	CYL3	CYL4	CYL5	CYL6	CYL7	CYL8
700	00	704	00	702	00	1000	00
702	00	704	04	702	00	1010	04
702	00	712	00	700	00	1024	00
770	04	720	04	700	04	1024	00
1000	04	720	00	704	04	1040	04
1010	00	730	00	1000	00	1040	00
1010	00	732	00	1010	00	1000	00
1024	04	750	04	1040	04	1000	04
1072	04	772	04	1032	04	1070	04
1000	00	1024	00	1000	00	1100	04
1112	00	1000	00	1112	24	1100	00
1112	04	1072	04	1120	00	1170	00
1132	04	1104	40	1120	40	1210	04
1104	04	1000	04	1100	40	1000	04
1170	00	1100	00	1172	40	1230	00



Assembled VTA head. Note the separate inlet manifolds

**"We decided to manufacture our own head and pattern equipment. We sat down and looked at the Lotus head for a long time, but we could see that the closer we stayed to the original design, the more expensive it would be to produce."**

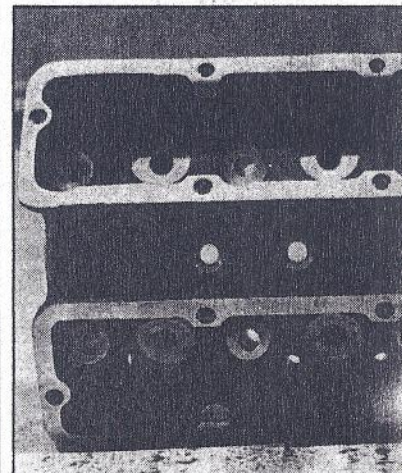
the line with one fitted in January 1963.

### Rethink

It was in his characteristically methodical manner that George sat down in 1980 to rethink the whole problem. The first steps were to identify the drawbacks of the original design. Oil tightness had always been a major problem, especially around the cam covers. This was due in part to the actual size of the cover, but also to the cork gasketry. Cork gaskets have never been that successful due to continual expansion and shrinkage of the material. Two half-moon seals at the front and rear of the cams also contribute to leaks, as does the lack of oil drainage from the head, causing the cams to pick up oil and thrash it around inside the cam covers. The alloy timing chain cover bolted to the front of the block and joining the head at right angles with yet another cork gasket, was asking for trouble.

The second major problem was overheating of exhaust valves. The original head has no waterways anywhere near the exhaust valve guides or seats,

**VTA head minus cam carriers. Two oil drainage (dummy pushrod) holes can be seen in the bottom portion (inlet side)**



# Vegantune VTA

**The recent development of the VTA head with its belt driven cams, by the famous engine tuning and Twin Cam specialists, has provided a source of new and superior heads to Twin Cam owners. It has also made it possible to convert any in-line, four cylinder, pushrod Ford engine to a Twin Cam, from 997cc upwards . . .**

**T**HE Ford based Lotus Twin Cam engine was first introduced in the early sixties, and eventually became one of the most famous and successful twin cam engines ever produced.

The Lotus Elan has always been powered by this unit, as of course have the classic Lotus Cortinas (Mk1 & 2) and the fabulously successful Escort Twin Cam.

Vegantune, headed by ex-BRM engineer George Robinson, became involved in the competition development of the engines in 1964 and have subsequently handled over 5,000 Twin Cam units, including extensive and varied competition modifications on an International basis.

### Dilemma

Eventually, the casting patterns for the cylinder heads became unavailable to Vegantune as Lotus were forced to send them to the US due to liability risks under the then new Product Liability Laws.

Vegantune eventually got them back, but incomplete. After manufacturing the missing bits themselves, it was discovered to their horror that the original head was going to be uneconomical to manufacture due to the fact that the original design provided for a first class cylinder head, but not ease of casting. The whole process would be far too labour



George Robinson, founder of Vegantune, designer of the VTA

intensive, requiring the castings to be passed from man to man for a variety of separate machining operations. The problem was that existing heads, were, by the late '70s, becoming pretty old and reconditioning of heads with bad damage (either from failure or previous crude attempts at reconditioning) was prohibitively expensive. Caterham Cars were in dire need of re-manufactured units for their Sevens, so something drastic had to happen.

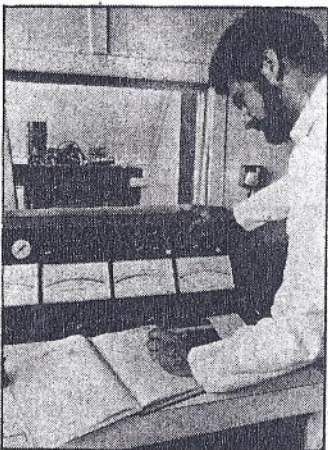
George Robinson thought the only way out was to design a new head and pattern equipment, which would be economical to manufacture, but also lose all the inherent problems of the original design, which were many.

Vegantune had been familiar with the Twin Cam (originally designated 125E) almost since the first production car rolled off

leading to sticking or 'lazy' valves, and burning. Lack of water capacity within the head coupled with the relatively low mass of the casting itself made it a prime target for overheating. Vegantune had discovered on a couple of occasions that turbocharging could lead to boiling of water in the heads. And, because of the imprecise method of holding cores during casting, waterways often varied, causing uneven waterflow — very nasty.

### Blue haze

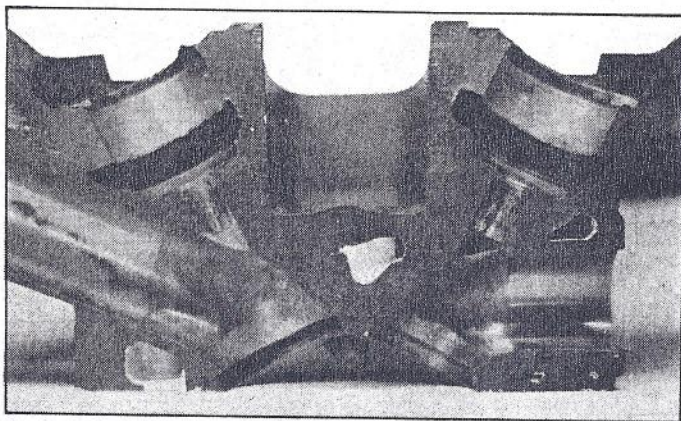
The third problem was oil drainage, particularly at the back of the head. A well on the inlet side, was joined to the block by means of a rubber hose (which leaked) and also by small 3/16" holes — also on the inlet side, drilled vertically to mate with the pushrod holes in the block.



VTA engine on the superflow dynamometer in test cell 'B'

Oil on the exhaust side of the head had to find its way over to the inlet side by means of a 5/16" oilway drilled across the head. There were no valve stem oil seals either, which resulted in pretty abominable oil consumption and a characteristic blue haze on starting, where oil had run down the valve stems into the bores while the engine was standing. Engines would sometimes start on 2 or 3 cylinders due to oil soaked plugs.

The new, VTA (Vegantune type 'A') head overcomes these problems. It has core plugs all the way round, three on each side, two at the back and one large one at the front, resulting in complete control over the



Section through a Lotus Twin Cam head. The exhaust port is on the right. The two small holes either side of the valve guide are the nearest waterways, hence the tendency for exhaust valves to overheat and stick

**"I stuck a piece of paper on the drawing board and drew in the basics of what we wanted (ie combustion chamber and port shapes), shoved in the valves and decided how we were going to achieve all the other instances."**

cores during casting. It also made for ease of withdrawing the wires afterwards. Some old Twin Cam heads still have the wires in them because they couldn't be removed after manufacture.

This has resulted in even waterways and a 30% greater water capacity, with plenty of it around the exhaust valves. Because of this, the engine can (and is) now turbocharged easily, without any overheating of valves at all.

Cam carriers are cast and machined separately, as coring would again have been a problem. This also makes for a clear oil flow beneath the carriers themselves.

Replacing the tiny 5/16" oilway, is a (cast in) 3/4" job instead. Control over cores has also made it possible to increase the size of the oil drainage dummy pushrod holes from 3/16" to 3/8". There's a generous well at the back of the head and the rubber tube to the block has been dropped altogether.

The new design can be machined in a third of the time taken for the old unit and this is done on Vegantune's multi-head, tape controlled equipment.

The camshafts run in four bearings each, operating valves inclined at 27 degrees and seating in the traditional hemispherical combustion chambers. Valves themselves are the Lotus Big Valve Twin Cam type, and are equipped with heavy duty rubber oil seals. Pistons are flat topped giving a compression ratio of 10.5:1.

**"Twin Cam water pumps fail with monotonous regularity. We put this down to stresses caused by opposing expansion and contraction forces of the alloy housing."**

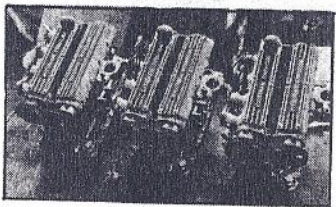
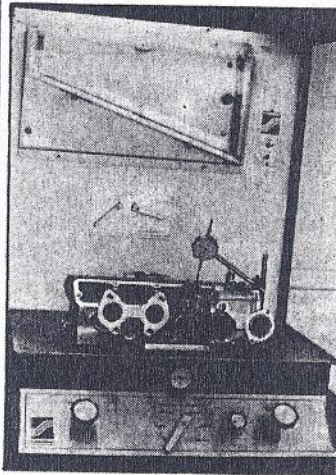
Unlike the original Twin Cam of the sixties, which used the 1500 pre-crossflow block, bored from 80.97mm to 82.55mm, raising the capacity from 1498cc to 1558cc, the VTA engine produced by Vegantune, uses the later Kent block with the 80.97mm bore and longer 77.62mm stroke, giving a capacity of 1599cc. One of the most important features is the water pump arrangement. The Twin cam pump is an integral part of the alloy timing chain cover and not only fails regularly, but takes about twelve hours to replace. The VTA engine with its toothed belt cam drive, uses a conventional Ford water pump that can be changed in minutes. There's a glass fibre cover for the belts themselves.

### Bottom end

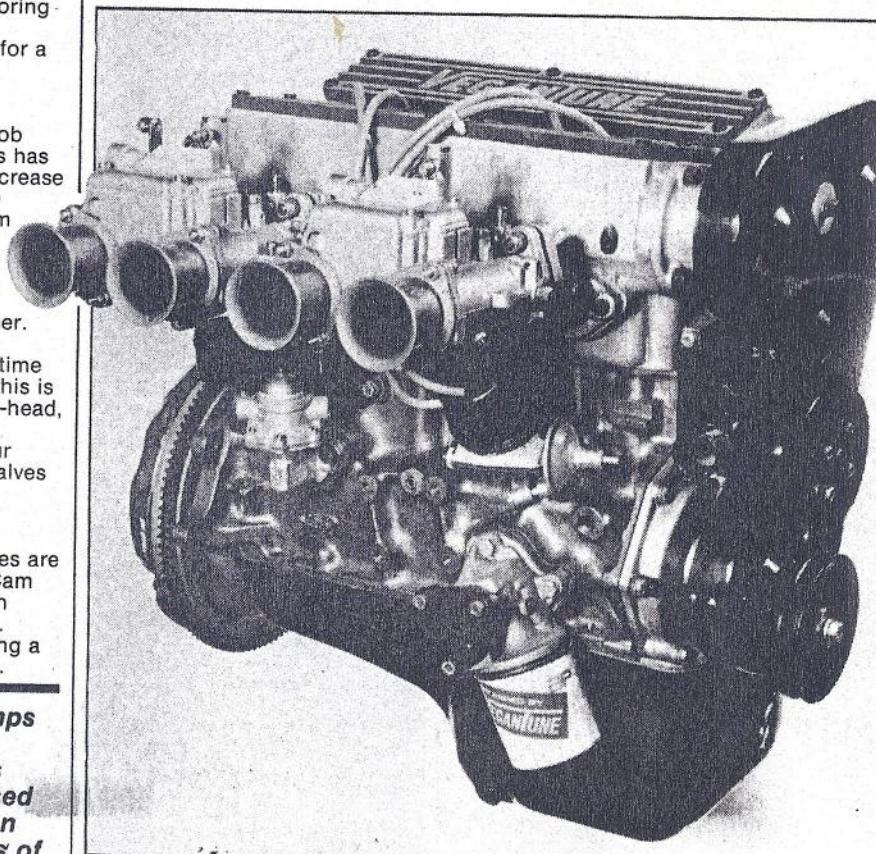
Fairly conventional this bit. The five bearing unit is already robust and good and reliable.

Vegantune fit a high pressure,

high capacity oil pump which produces 50psi at 5,000rpm and produces an oil flow of 6 gallons per minute. The bottom end is, naturally, balanced to racing standards and there's provision for an oil cooler. Although there's no dry sump version available yet, one is under development for competition use. If you buy a complete engine, ready built, you can rest assured that it will be bench run and dyno certificated.

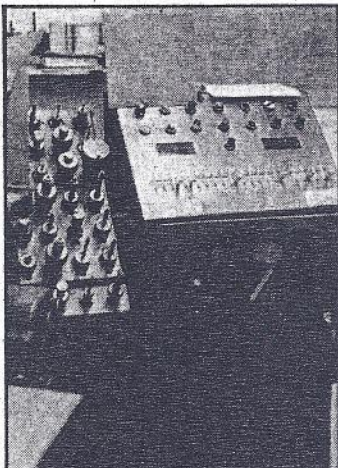


Top: VTA head on the flow bench, all are checked in this way. Bottom: Three VTA's awaiting delivery to Caterham Cars for the Caterham Seven

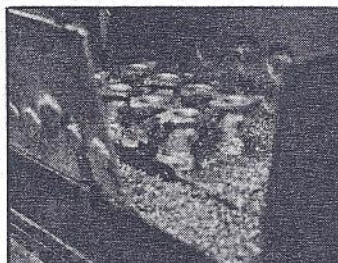


Complete, and highly desirable looking VTA. Note glass fibre timing belt cover giving easy access to water pump

# Vegantune VTA



**Tape controlled milling machinery, makes production economical**



**Manifolds in position on bed of tape controlled machinery**

## What's available?

Now comes the good fun bit, and perhaps just a touch outrageous.

You can, of course, purchase a complete engine from Vegantune for 1,730 smackers plus VAT. But there are also kits available for converting your Twin Cam in the kitchen at home. This consists of a complete head, pulleys, belts, water pump and inlet manifolds. These are separate on the VTA and not integral castings as on the old Twin Cam. You also get a new head gasket, in fact everything you need to do the conversion. Exhaust manifold is the existing Twin Cam item.

There's also another kit for converting a Kent engine to Twin Cam. This will, of course, involve changing the pistons to flat top. So this kit consists of head (plus bits), pistons and twin 40 DHLA Dellorto carburettors, and retails at £899 plus VAT. You'll also need a Twin Cam exhaust manifold and an exhaust pipe to fit.

Have you sussed the good bit yet? Yes, you've got it. Vegantune tell me that it is now possible to convert any in line, four cylinder, pushrod Ford engine to twin cam. And that includes mum's 997cc 105E Anglia. And because the manifolds are not integral with the head, they could theoretically be specially made to suit a particular application (at a high cost).

In fact an actual trial showed that you would get over 90bhp from a 997cc engine, which for a road going conversion, is quite impressive. This is all fairly

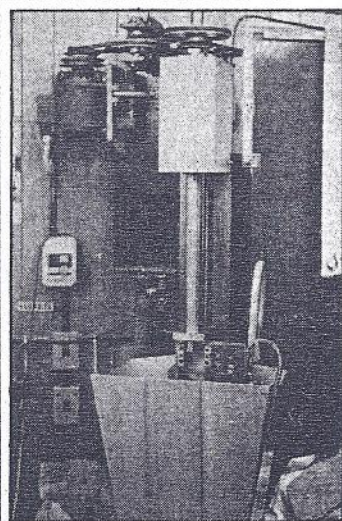
theoretical really, because if you were looking for power on the road, the 1600cc size would be the obvious choice. But it's a fun thought. Just imagine mum climbing into her little Anglebox on a Saturday morning, to get to the hairdressers in a hurry, and somebody's done a quick switch overnight without telling her. It doesn't bear thinking about.

On a more serious note though, a 997cc or 1300cc Twin Cam lump, with all that torque and horsepower, could be very useful to the club competitor who's looking for a lot of power in a certain class. Camshafts are supplied to suit the capacity.

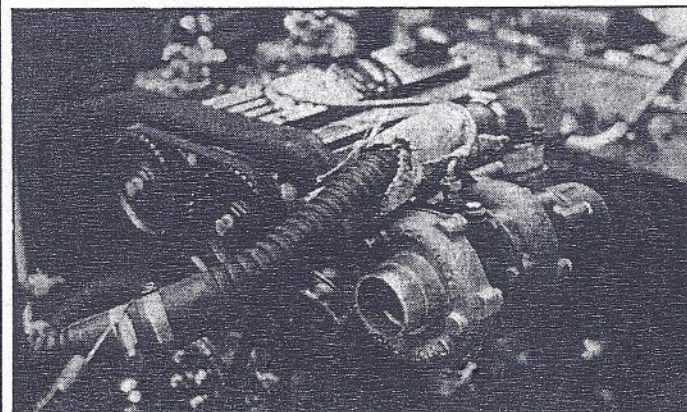
Probably more relevant to the 1600cc size is the type C head. The standard head produces about 130bhp (the original Twin Cam developed 105-115bhp, depending whether it was an early or later model) but the type C delivers 150bhp.

## Driving impressions

I drove the engine as fitted to the Vegantune 'Q' car which is, believe it or not, a MkIII Cortina Estate, which is used as a hack. The idea of this is to give the VTA unit a long term test to find out how well it survives continual short journeys and so on. It seems to survive quite well and when I drove the car at dusk, across the dyke flanked lowland of Lincolnshire, the



**No suitable machine was available for line boring cam carriers, so Vegantune manufactured their own**



**Close up of VTA Turbo on dyno. A tractable 200bhp — yum, yum**

Superflow-800 engine dynamometer test at Vegantune, on a standard VTA 1600 engine

RPM	HP	TORQUE (lbs/ft)
3000	51	90
3500	61	92
4000	79	104
4500	96	111
5000	108	113
5500	119	113
6000	129	113
6500	131	105

Superflow-800 engine dynamometer test at Vegantune, on a Turbo VTA engine

RPM	HP	TORQUE (lbs/ft)
4000	116	152
4500	133	154
5000	151	158
5500	178	162
6000	183	160
6500	194	156
7000	190	143

Specification — standard VTA

Cylinders: 4  
Bore: 80.97mm  
Stroke: 77.62mm  
Capacity: 1599cc  
Valve gear: Opposed in hemispherical head. Twin-overhead camshafts, tooth belt driven  
Compression: 10.5:1  
Max bhp: x 130 @ 6,250rpm  
Max torque: 123 @ 5,000rpm  
Carburettors: 2 Dellorto 40 DHLA  
Fuel pump: Engine operated diaphragm  
Sump capacity: 7.5 pints

Specification — Turbo VTA

Cylinders: 4  
Bore: 80.97mm  
Stroke: 77.62mm  
Capacity: 1599cc  
Boost pressure: 5psi  
Max bhp: 195 @ 6,450rpm  
Max torque: 150lbs/ft @ 5,500rpm  
Valve gear: As std VTA  
Cams: VJ 30T  
Fuel pump: Std VTA  
Carburettors: Dellorto 40 DHLA turbo  
Turbocharger: Garrett Airesearch T.0.3 waste gate system with fabricated manifold

engine responded with that familiar long legged wallop, and characteristic blood curdling bellow from the 40's.

Trouble was, as I got more carried away by the sound and tractability of this delicious power unit, I began to forget what I was actually driving... until I got to the first corner, that is. The VTA isn't for the faint hearted however, letting the driver know in no uncertain manner what he's got under the bonnet. I'm talking of course about induction noise, the type

that goes with all twin choke carburettor set-ups. Some people love it (I do) but it's certainly an enthusiast's noise.

All in all though, loads of power (obviously) and loads of torque. Unfortunately the ratios of the old Cortina box weren't quite what I'd choose (felt like about 4,000rpm between third and top). But the engine also seems smooth and unfussed at low speeds, although I haven't driven it in traffic.

## Turbo

Vegantune have also developed a turbo version of the engine using a Garrett Airesearch Turbo/waste gate system. The block has special rings fitted as well as a head gasket to cope with the extra pressure.

The turbo installation is also available (to be fitted in conjunction with a VTA head) as a kit. This is around a £1,000 on top of the head kit, but will deliver 195bhp at 6,450rpm. Maximum torque of 150lbs/ft, is developed at 5,500rpm, and turbo boost is 5psi.

So, if you're interested in any of these options, contact: Vegantune, Cradge Bank, Spalding, Lincs, PE11 3AB, tel. Spalding (0775) 4846.

Jesse Crosse

Complete All New VTA Engine Units

VTA1 Sprint 130 BHP V.T.A. Engine Complete and Dyno Tested 1600cc	£1,729
VTA2 G3 150 BHP V.T.A. Engine Complete and Dyno Tested 1600cc	£1,949
VTA3 G3+ 165 BHP V.T.A. Engine Complete and Dyno Tested 1600cc	£2,099

Prices and details of 1100cc, 1300cc and 1760cc units are on request.

Vegantune Type "A" Twin Cam

Conversion Kit

VTA4 Sprint V.T.A. Engine Conversion Kit	£966
VTA5 G3 "C" Type Basic conversion Kit 150 BHP	£1,186
VTA6 G3+ "C" Type Gasflowed and Prepared Conversion Kit 165 BHP	£1,336

VTA Engines Exchanged For

Lotus Twin Cam Units

VTA7 Sprint 130 BHP 40mm Carburettors Complete and Dyno Tested	£1,399
VTA8 G3 150 BHP 40mm Carburettors Complete and Dyno Tested	£1,617
VTA9 G3+ 165 BHP 45mm Carburettors Complete and Dyno Tested	£1,857

These engines use remanufactured Lotus/Ford or 1600 Kent short motors.

Please note: Twin Cam units for exchange must be reserviceable.

Ford 1600cc Engines Exchanged For

Remanufactured Ford Kent Short Motors

Fitted With New VTA Cylinder Heads

VTA10 Sprint 130 BHP on 40mm Carburettors Complete and Dyno Tested	£1,499
VTA11 G3 150 BHP on 40mm Carburettors Complete and Dyno Tested	£1,717
VTA12 G3+ 165 BHP on 45mm Carburettors Complete and Dyno Tested	£1,867

Plus VAT At Current Rate



Additional Parts Available For

V.T.A. Engine

Pistons 1600cc Ford Standard and Oversize

Pistons 1300cc Ford Standard and Oversize

Pistons 1558cc Ford Lotus Standard and Oversize

Pistons 1500cc Ford Standard and Oversize

Set Carburettors 40mm

Set Carburettors 45mm

Carburettor Space Plates Plus 8 "O" Ring Nuts and Washers

Distributors Assembly

Block Breather Assembly 1600cc

Block Breather Assembly 1300cc

Block Breather Assembly 1500cc and 1558cc

Air Filters and Back Plate Assembly

Exhaust Manifold for Lotus Elan and +2

Exhaust Manifold for Lotus Seven S3

Exhaust Manifold for Lotus Seven S4

CONTENTS

Sprint Vegantune Type "A" Conversion Kit

12	Cam cover allen bolt
16	Exhaust stud/inlet stud 6101397
8	Inlet stub 26E6027
8	Inlet nyloc and washer
4	Inlet manifold gasket
18	Cam carriers to head bolt washer 8mm ID - 12mm OD
18	Cam carrier to head bolt
7	Cylinder head core plugs 1796726
2	Cam seals
8	Cam seal carrier bolts
1	Head belt tension bearing pivot
1	Oil filler cap 6077139
10	Cylinder head bolt
10	Cylinder head bolt washer
2	Thermostat housing bolt and washer
2	Head to cam carrier 'O' ring seal
3	Cam belt pulley 1438060
3	Cam belt pulley washer and bolt
1	Timing belt
2	Belt tensioner bearing
1	Top tensioner bearing adaptor
2	Belt bearing bolt and washer bolt and washer
1	Head gasket
8	Valves
1	Set valve springs
8	Spring seat washers
4	Inlet valve set
4	Exhaust valve set
8	Valve spring retainer
5	Front cover casting bolt and washer
2	Idler pulley ring
1	Idler boss
1	Jackshaft adaptor
1	Crank adaptor
1	Crank washer
16	Valve collets
4	Inlet valve guides
4	Exhaust valve guides
8	Valve guide circlip
1	Water pump
3	Water pump bolt and washer
1	Front cover/water pump gasket 1536187
1	Water pump pulley
1	Water pump pulley adaptor
1	Front cover seal
1	Crank toothed pulley 1516068
1	Crank V pulley 1535582
1	Front crank seal
8	Tappet buckets
8	Valve stem seal

cont.....

cont.....

3	Woodruff keys
3	Cam keys 0242650
8	Tappet shims.
2	Cams
2	Cam seal housing
2	Cam carrier
2	Inlet manifold
1	Cylinder head
2	Cam cover
1	Thermostat housing
1	Front cover
1	Tube silicone