

COSWORTH ENGINEERING LTDCOSWORTH FORD TYPE FVA ENGINEGeneral Information 1969

Capacity 1594cc Bore 3.375" Stroke 2.722" 4 Cylinder
 Compression ratio 12 to 1
 Gross horsepower rating 225 bhp minimum @ 9,000 rpm
 Gross torque rating 135 lb. ft. @ 8,000 rpm

SPECIFICATION

Cylinder Head: Cast Aluminium Alloy with alloy bronze seat inserts and valve guides.

Cylinders: C.I. - Bored in block. Bore dia. 3.3730"/3.3755"

Crankshaft: Nitrided-steel. End play .002" - .011" - .011"
 Thrust taken by two half thrust washers. Main journal dia. 2.1255"/2.1260"
 Conn-rod journal dia. 1.9370"/1.9375"

Main Bearings: Cosworth part number PP0012
 5 main bearing caps are steel

Camshafts: Monikrom. Each running in five bearings. Driven by a train of eight gears from the crankshaft.
 Bearings - white metal shell type.

Valve mechanism: Inverted piston type tappets, running directly on the camshafts. Four valves per cylinder.

Valve Timing: Cosworth Camshafts FI Profile
 Inlet valves fully open 102° A.T.D.C.
 Exhaust valves fully open 102° B.T.D.C.

Connecting Rods: Material EN24. Length, centre to centre 4.826"
 End play .004" - .011"

Big-end Bearings - Cosworth Pt. No. FA 0067

cont.....

- Valves - Inlet Material 21-4-NS alloy. Head diameter 1.32"
Seat angle 45°. Stem dia. 9/32" nominal.
- Exhaust Material 21-4-NS alloy. Head diameter 1.15."
Seat angle 45°. Stem dia. 9/32" nominal.
- Valve Springs: Double springs, variable-pitch wound outer.
Rate 260 lb/in. Free length 1.65", fitted
length 1.30/1.31" (both measured on outer).
Close coils to be fitted at head end.
- Pistons: Special Cosworth/Hepolite, forged in RR.59
Two compression rings, one oil control ring.
- Gudgeon Pins: Hollow taper bored. Ground o/d., 13/16" dia.
nominal. Clearance .0002" - .0005". Retained
by spacial flat circlips. Cosworth Pt. No. FB 0006
Gudgeon pin end float .001 - .004.
Note: Pins ground to length to suit each piston.
- Compression Rings: Top ring. .030 Thick. Plain Cast Iron or Dykes Chrome
Second ring. .040 Thick. Cast Iron. Plated
- Oil Control Ring: Twin Land Single Cast Iron.
- Water Pump: Impeller type - driven from front of jackshaft
- Lubrication: See diagram -page 4
Dry sump full pressure system
Main bearings - pressure fed
Connecting rods - pressure fed.
Gudgeon pins - splash.
Cylinder walls - splash.
Camshaft bearings - pressure fed.
Tappets - splash and jet
Timing gears - splash
- Oil Pumps: 'Hobourn-Eaton' type, Cosworth designed,
mounted on side of cylinder block.
- Oil Filter: Supplied with engine, with special felt cartridge.
Felt cartridge replacement, Cosworth part no. PPO233
Note: Oil pressure gauge pipe union in top of
filter.
- Distributor: Lucas High Speed contact type. Anti clockwise
rotation. Firing order 1,3,4,2. Centrifugal advance
10° - 13° on distributor, i.e. 20° - 26° on flywheel.

cont.....

Fuel Injection: Based on Lucas Mk II units. Timing No. 1 starts to inject 20° A.T.D.C. No. 4 firing. Fuel injection timing is sometimes changed on test, but above figure is average timing.

Inlet Manifold: Cast with slide throttle housing.

MAINTENANCE AND RUNNING DATA

Oil Pressure: 70 min. psi 80-90 psi normal at running speeds, i.e. above 7,000 rpm.
Pressure falls to 15-25 psi at 2,000 rpm when hot.

Max. Oil Temperature: 100°C, measured in tank.

Tappet Clearance: .009 - .010" inlet, .011-.012" exhaust (cold)

Oil: Shell SC2 or equivalent.
Any oil starvation will cause immediate big end shell failure.

Fuel: Normally 100 octane. Pressure should be maintained above 110 psi. Adjust pressure relief valve if necessary.

Sparking Plugs: Autolite PG 403 or equivalent.

Bolt & Nut Tightnesses:

Cylinder Head	53-55 lb ft torque
Main Bearing Cap	55-60 lb ft torque
Cam Bearing Cap	13-15 lb ft torque
Flywheel to Crank	45-50 lb ft "
Clutch Fix Nuts	12-14 lb ft "
Big End Bolts	40-41 lb ft "

Special Note: Big End Bolts with "V" marked on head should be fitted with molybdenum-disulphide anti-scuffing paste under head and engine oil on thread.

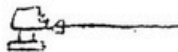
Head Tightening: Number bolts starting from front 1-5 on exhaust side, 6-10 on distributor side, then order of tightening is 8,3,7,4,9,2,10,1,6,5.

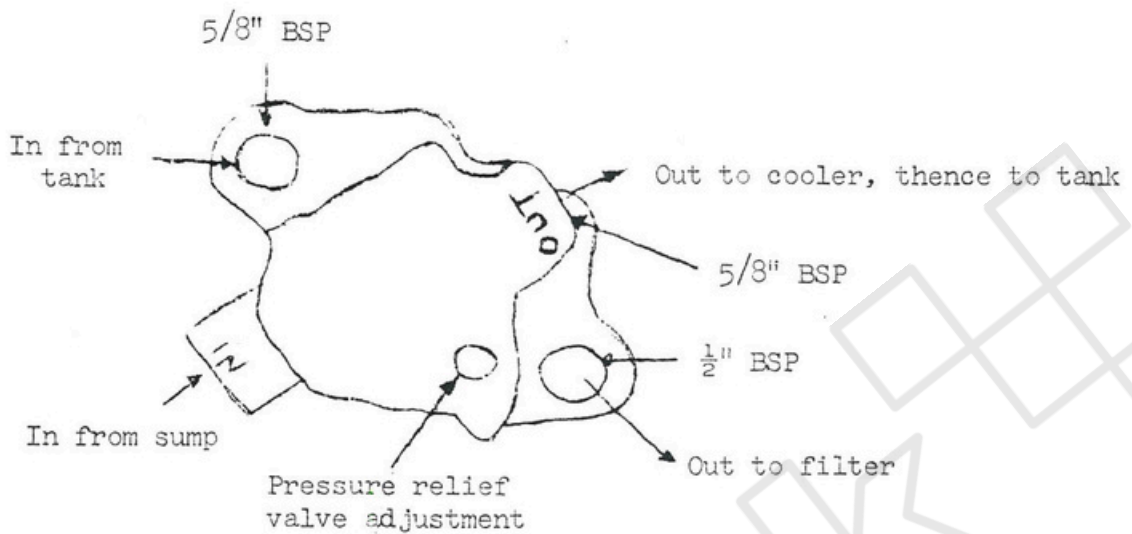
There is also a long 5/16" UNC Allen screw in the front cover tying the compound gear bearing housing to the top idler bearing housing in the block. This should be removed first when removing the head, and tightened last when replacing.

Rev. Limits: Safe limit 10,000 rpm. 9,500 in first and second gears. Drivers should be made aware that due to tachometer reading lag it is quite easy to exceed 10,000 rpm in low gears even though the tacho reading is well below 10,000 rpm. This is by far the major cause of engine failure.

cont.....

OILING CONNECTIONS

 oil pressure off-take



DIAGRAMMATIC VIEW ON SIDE OF ENGINE

Oil pressure Gauge take off from top of filter casting.

Pressure oil delivered by $\frac{1}{2}$ " bore pipe from filter into left side of engine at mounting boss.

Oil Pipe Sizes:

From oil tank to inlet side of pressure pump should be $\frac{5}{8}$ " bore min. and free from sharp bends. Pressure circuit from outlet of pressure pump through filter to inlet to main gallery at engine mounting should be $\frac{1}{2}$ " bore min. Scavenge return to tank should be $\frac{5}{8}$ " bore min.

Oil Pumps Assembly:

If the oil pumps assembly is for any reason dismantled, it is imperative that when re-assembled the shaft may be turned freely by hand before the unit is re-fitted to the engine. If this is not possible then the driving gears will suffer, owing to the load placed on them. Any dirt which finds its way into the pumps will have a similar effect.

Providing these instructions are followed, the driving gears have proved to give no trouble at all.

cont.....

STRIPPING AND ASSEMBLY NOTES

The camshaft and cam-covers must be removed before the cylinder head can be lifted, and care should be taken to see that each camshaft is kept parallel to the head as it is lifted, by undoing the bearing cap nuts an equal amount and only one or two turns at a time. If the camshaft is allowed to 'kick up' at the rear it may cause damage to the front bearing thrust flange.

When removing the head, slacken off the front 5/16" UNC socket cap screw before undoing the rest of the cylinder head nuts, and having removed the cylinder head take care not to lose the .003" shim washer under the aluminium gasket at the front timing cover joint. When refitting the cylinder head turn the engine to top dead centre, with the rotor arm at No. 1 firing position and see that the mark on the front timing cover adaptor plate is exactly in between two teeth on the top timing gear on the cylinder block. This should ensure correct meshing and timing, if all the timing marks in the cylinder head gears have been lined-up during assembly.

FUEL SYSTEM

Adjustment of Fuel Cam

The fuel cam is set to the correct stroke during assembly and test, and although this may alter from time to time throughout the development life of the engine, the current settings for the cam are .005"/.006" stroke at the idling throttle position, and .088"/.091" stroke at full throttle. The full throttle position of the cam is when the straight edge of the cam is at 45° sloping upwards towards the front of the engine. At this angle the stroke should be adjusted by shimming to give full stroke as shown above, then, having mounted the metering unit on to the engine, the threaded rod should be adjusted so as to hold the cam in the 45° position with the throttle fully open. From this setting one or two turns shortening or lengthening of the control rod should give the above stroke when the throttle is closed to the idling position. NOTE It is not necessary to have the cam exactly at 45° at the full open position, as the cam gives constant stroke over a large number of degrees near full throttle.

Mechanical Fuel Pump

Each time the engine is installed into the chassis the small plastic plug fitted in one of the holes on top of the fuel pump drive housing should be removed and engine oil squirted in this hole until it comes out of the other small hole about 1/2" away. This ensures adequate lubrication of the seal on the pump drive shaft.

NOTE: DO NOT OPEN THROTTLE BY MOVING FUEL CAM

cont.....

RECOMMENDED EXHAUST SYSTEMS

Pipes are measured from head face to end of tube, or from end of joining tube inside junction to end of tube.

- | | | |
|-------------------------|-----------------------------|-------------------|
| 1. "Four to two to one" | 4 primary pipes 1 7/8" O.D. | 18 SWG x 15" long |
| | 2 secondary pipes 2" O.D. | 18 SWG x 15" long |
| | Tailpipe 2 1/4" O.D. | 18 SWG x 30" long |
| 2. "Four into one" | 4 pipes 1 7/8" O.D. | 18 SWG x 27" long |
| | Tailpipe 2 1/4" O.D. | 16 SWG x 28" long |

COLD STARTING

When starting in cold conditions, the metering unit may go tight and break the toothed drive belt. To obviate this, warm the metering unit (by, for example, pouring hot water over it) before attempting to start the engine.

PLUG LEADS

Plug leads should be removed only by using special pliers gripping the moulded end - pulling on the conductor wire may cause breakage, followed by missing on that cylinder.