

C O S W O R T H

Mibb

ISSUE 4. 5TH JULY 1976.FVC ENGINE DETAILS

Capacity	109.24 cu. in. 1790 cc	Bore	3.373" 85.6 mm	Stroke	3.056" 77.6 mm
Compression Ratio:	12 to 1 (approx) Configuration: 4 cylinder in line				
H.P. Rating:	240 bhp (min) 8,500 rpm				
Torque:	160 lb ft (min) 7,000 rpm				

CYLINDER NUMBERINGFRONT 1 - 2 - 3 - 4 REARIMPORTANT DIMENSIONS ETC.

<u>Crankshaft</u>	End Float	.002" / .011"
	Main journal dia.	2.1255" / 2.1260"
	Conn Rod journal dia.	1.9375" / 1.9370"
	Gear-drive quill interference	.0010" / .0015"
<u>Connecting Rods</u>	End-Float (Big End)	.004" / .012"
<u>Gudgeon Pins</u>	End-Float	.001" interference / .001" clearance
<u>Piston Rings</u>	Gaps on all rings	.017" / .022"
<u>Valve Timing</u>	Inlet valves fully open	102° A.T.D.C.
	Exhaust valves fully open	102° B.T.D.C.
<u>Valve Lift</u>	.410" less the tappet clearance	
<u>Tappet clearance</u> (cold)	.008" / .009" inlet, .014" / .015" exhaust	
<u>Valve Springs</u>	See Drawing Nos. FA 0290 and FA 0291 Current arrangement is FA 0291	
<u>Oil Filter</u>	Element Cosworth Pt. No. PP 0233	
<u>Fuel Injection Timing</u>	No. 1 starts to inject 18° A.T.D.C. No. 4 firing	
<u>Fuel Metering Datum Pin</u>	Cosworth Pt. No. DA 0159	
<u>Ignition</u>	Firing order: 1 - 3 - 4 - 2 Distributor contact-gap- .015 Ignition timing is set at 8,000 rpm on test approximately 35° B.T.D.C.	
<u>Tachometer</u>	If a "Smith's Chronometric" tacho head is fitted, then the specification for the head is 3.85:1, Clockwise.	

COSWORTH FVCOil System

See Drg. No. FA 0264

Pressure when hot 70 psi min., 80 - 90 psi at normal running speeds. Care must be taken to allow the engine to reach 50° C before exceeding 7,000 rpm as bearing failure may follow running at high speeds with cold oil. All engines tested before delivery on Shell SC oil.

Max. oil temp. 100° C (measured in tank)

Fuel System

See Drg. No. FA 0128

Fuel - 101 octane (motor method)

Metering unit feed pressure should be maintained above 110 psi. Adjust pressure relief valve if necessary. The mechanical pump drive-shaft seal must be lubricated each time the engine is installed via the hole on top of the drive-shaft housing, sealed by the small plastic plug. Oil should be gently fed into this hole until it comes out of the other small hole 1/2" away. Replace the plug afterwards.

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 .093"/.094" stroke at full throttle, with the datum-pin set in the "1 from full lean" position.

It is of the utmost importance that the stroke is not less than .093" at full throttle, since a smaller stroke is likely to shorten piston life. A feeler gauge Pt. No. FA 0262 is available to check the stroke. 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 fully open position, as the cam gives constant stroke over a large angle near full throttle.

NOTE: DO NOT OPEN THROTTLE BY MOVING FUEL CAM

Alternative fuel cams and feeler gauges are available for high-altitude circuits - See Fuel Cam Data Sheet.

Electrical System

See Drg. No. FA 0129

Spark Plugs: Autolite PG 403 or equivalent.

Before removal, clear all dirt from recess. Use special pliers to remove spark plug connectors; do not pull directly on H.T. leads.

Cooling System

A "Barseal" capsule should be added to the cooling system, each time the engine is installed in the chassis. In cold weather, usual precautions should be taken against freezing.

COSWORTH FVCRev. Limits

Recommended limit 9,000 rpm, 8,500 rpm in first and second gears. Drivers should be aware that due to tachometer reading lag it is quite easy to exceed 8,500 rpm in low gears even though the tacho reading is well below 8,500 rpm. This is a major cause of engine failure. The engine must not be allowed to idle under 2,000 rpm or excessive cam and tappet wear may be experienced. Also see note under Oil System above,

Related Drawings

FA 0087 (2sheets)
 FA 0128
 FA 0129
 FA 0264
 FA 0289
 FA 0290
 FA 0291

STARTING FROM COLD & WARMING UP

Set mixture datum adjusting pin to full rich, switch on electric pump, fully open throttle and crank for 3 - 4 seconds with starter motor. Ease off throttle to approximately 1/3 open and switch on ignition whilst engine is still being cranked.

Reduce throttle opening when engine fires.

Observe that oil pressure has come up, adjust rpm to 2,300 and hold steady at this rpm - or reading near this which gives a minimum mechanical clatter.

As soon as water temperature gauge needle is off the stop, i.e. 30°C increase rpm to between 4,000 & 4,500, again choosing a point where mechanical clatter is minimised. Turn mixture datum adjusting pin to middle notch, to weaken mixture.

Keep rpm steady till water temperature reaches 60 - 70°C and oil temperature is rising. See also under 'Oil System'

COLD WEATHER CONDITIONS

It has been found that some Fuel Metering Unit failures have been caused by attempting to start the engine in very cold weather. We therefore suggest that when the general engine temperature is below 5°C, the metering unit is warmed before any attempt is made to rotate it.

RE-COMMENDED EXHAUST SYSTEM

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

"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. 16 SWG x 30" long

COSWORTH FVCSTRIPPING & ASSEMBLY NOTES

Oil Pumps: If the oil pump assembly is for any reason dismantled it is imperative that when reassembled 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.

The cam-shafts and cam cover 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; (on later engines the shim and aluminium gasket are both replaced by a single special fibre gasket)
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 on the cylinder head gears have been lined up during assembly.

Head Tightening Number bolts starting from 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.

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.

Throttle Slide It is inadvisable to dismantle the throttle- slide assembly while it is still bolted to the cylinder head, otherwise balls and/or rollers from the slide bearing track may fall down an inlet port. We advise that if it is necessary to dismantle an assembly, it should first be removed from the cylinder head, (by unscrewing the nine 5/8" long x 1/4" UNC socket-cap screws, securing the manifold casting to the head) and then be carefully dismantled on a bench. The balls and rollers must be re-assembled into the bearing track in the right order, as any change in this arrangement will result in slide inefficiency.

Camshafts When fitting a new camshaft for the first time, it is important to smear each lobe with anti-scuffing paste before assembly; otherwise there is a danger of breaking the shaft when it 'cracks' into position.

Crankshaft Bungs Engines up to No FVC 70077 were originally fitted with threaded gallery crankshafts. Crankshafts which have threaded oil galleries should be fitted with bung Pt. No. FA 0278 (see Data Sheet). These are not re-usable. Crankshafts which have plain reamed oil galleries (Engines No. FVC 70078 on) should be fitted with bung Pt. No. FA 0286. These are re-usable, see Drg. No. FA 0289 for assembly details.

COSWORTH FVC

TORQUE SETTINGS - Engine oil on threads and underhead unless otherwise stated.

Big end bolts (Marked "V")	41 - 42 lb ft	Anti-scuffing paste underhead and engine oil on threads
Main Bearing Cap Bolts	55 - 60 lb ft	
Cylinder head stud nuts	53 - 55 lb ft	
Cam-cap stud nuts	13 - 15 lb ft	
Flywheel bolts	58 - 62 lb ft	
Clutch bolt nuts	13 - 15 lb ft	
All 1/4 UNC Socket Cap Screws	46 - 48 lb in	
Sparking Plugs	9 lb ft	Graphite grease on threads and underhead.