

BDD ATLANTIC ENGINE DETAILS

ISSUE 14. 7TH MAY 1981.

Capacity: 97.52 cu. in. Bore: 3.187 in. Stroke 3.056 in.
1598 cc. 80.96 mm. 77.6 mm.

Compression Ratio: 12.0 to 1.

H.P. Rating: 210 bhp @ 8750 r.p.m.

Torque: 139 lb. ft. @ 7000 r.p.m.

CYLINDER NUMBERING FRONT 1 - 2 - 3 - 4 REAR

IMPORTANT DIMENSIONS

Crankshaft

End Float .002/.011 in.

Main Bearing dia. 2.1260/2.1255 in.

Crankpin dia. 1.9375/1.9370 in.

Connecting Rods

End Float at Big End .004/.012 in.

Jackshaft

End Float .003"/.007"
Jackshaft Part No. BA 0502

Jackshaft pulley is bolted to jackshaft with:-
1 Bolt 3/8 UNC & BA 0510 washer.

It is recommended that 'Silastic' is used under the
washer to prevent oil leaks.

Valve Timing

Inlet valves fully open $102^{\circ} \pm 1^{\circ}$ A.T.D.C.
Exhaust " " " $102^{\circ} \pm 1^{\circ}$ B.T.D.C.

Lap cam pulleys onto cams. With timing set correctly & belt correctly
tensioned, timing marks on pulley rims should line up horizontally in the
centre of the engine. When No. 1 piston is at T.D.C. (Firing).

If the marks do not line up it is advisable to re-mark the pulleys, so
that the engine can be easily re-timed on rebuild.

Valve Lift

.410 in. less the tappet clearance.

Tappet Clearance (cold)

.009/.010 in. inlet .012/.013 in. exhaust.

Timing Belt Tension

Taken on long slack side of belt
with Burroughs Gauge (see instructions)

COSWORTH BDD

ISSUE 14. 7TH MAY 19.

Valve Springs

Cosworth Part No. PP 1656 Pair of Springs.

Fitted length of outer 1.26"/1.27"

Free length of outer 1.44"

Ignition

Firing order 1 - 3 - 4 - 2

Lucas 'Opus' ignition.

Ignition timing is about 34° B.T.D.C.

Timing is set on test with timing light at 7000 r.p.m., and may vary slightly from engine to engine for maximum performance.

Electrical System

See Drawing No. BA 0498.

Current engines use PP 1117 (Thyristor Speed Limiter) set to cut out at 9,500 r.p.m.

The engine must be connected to a Negative Earth (ground) system.

It is advised that all electrical connections are smeared with silicone grease (we suggest Midland Silicones MS4) especially when the engine is operated in wet conditions.

Spark Plugs - Champion N54R or equivalent. If cold starting proves difficult on N54R, a set of N60 may be used for initial warming-up but should not be used for racing purposes. Before removing plugs, clear all dirt from recess. Use special pliers to remove H.T. leads - do not pull directly on leads. Use graphite grease on plug threads and torque to 15 lb. ft.

TAPPET ADJUSTMENT

Rotate engine forwards to T.D.C. (cam pulley marks lined up). Mark metering unit drive pulley to housing and remove belt. Remove main camshaft belt, having slacked off eccentric pulley, to remove tension from belt. (N.B. always refit belts to run in the same direction as before).

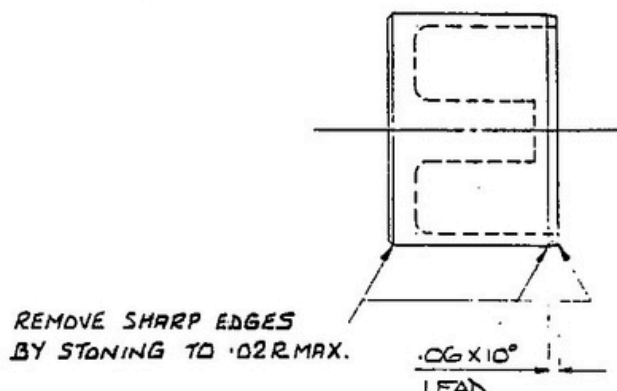
Retain tappet up against the cams, preferably by inserting 8 spring clips between adjacent tappets. Remove surplus oil from tappet chambers with a syringe. Slacken off hex. head bolts, ensuring cam carrier lifts evenly. Carefully lift cam carrier assembly vertically until clear of the valve stems and shims. Some shims may stick to the tappets and some to the valve stems. When rebuilding an engine it is advisable to stick the shims to the valve stems with grease, whilst carrying out tappet adjustments, to ensure the shim remains on the valve stem whilst removing the carrier.

CYLINDER HEAD

Number bolts 1 - 5 exhaust side, 6 - 10 inlet side, then order of tightening is:- 8, 3, 7, 4, 9, 2, 10, 1, 6, 5.

TAPPETS

Standard tappets may be used, but the modification shown in the sketch below is recommended to avoid excessive wear of the tappet bores, or use BA 0276 Tappet Pistons which are already modified.

Camshaft Oil Seals: (PP 1281)

To prevent failure in service it is recommended that the garter spring is removed, the ends untwisted, degreased and reassembled with Loctite 602.

CAM CARRIER

It is recommended that 'Silastic' is used to make an oil tight joint between the cylinder head and cam carrier and that the paper gasket is omitted.

BELT TENSION AND VALVE TIMING

All pulley's are to be sprayed with A.D.F. (air drying lubricant film - Molybdenum Disulphide) on initial assembly.

Belt tension should always be set with a cold engine. Tension is adjusted by moving the eccentric idler pulley.

To check tension, turn engine in its normal direction of rotation to T.D.C. number 1 cylinder firing. Tension should be checked midway between the exhaust camshaft pulley and the crankshaft pulley. It is important that each time the tension is being adjusted and checked the engine is brought up to T.D.C. number 1 cylinder firing in its normal direction of rotation. It is essential that the belt is not over tensioned, as this will result in premature tooth failure.

We recommend the use of Burroughs Tension Gauge BT 33-86F 4-18 and the tension should be set at 90/100 gauge reading. Alternatively a Gates Tension Tester may be used, and for 1/2" belt deflection a gauge reading of 11/15 lbs. should be obtained.

On new engine build the camshaft pulleys are marked on the front rims on their horizontal centre line. These marks line up in the centre with the engine at T.D.C. number 1 cylinder firing. A further mark is on the rear of the exhaust camshaft pulley, which lines up with a scribed line on the crankshaft pulley with the engine again set at T.D.C. number 1 cylinder firing. When checking the timing marks, or timings, always turn the engine in its normal direction of rotation, with the belt correctly tensioned.

The camshaft pulleys are a taper fit on the camshafts, and have two 1/4" UNC tapped holes to facilitate removal. On new engine build the end of each camshaft and pulley hub face are scribed with a horizontal line in order that the pulleys can be re-fitted in their original position.

COSWORTH BDDOil System

See Cosworth Drawing BA 0285 for layout of recommended oil system, which shows oil pipe sizes etc.

Note that pipes into the oil/air separator, built into the top of the tank, should enter tangentially with the oil scavenge pipe ahead of the engine breather pipe.

Oil pressure when hot should be 70 p.s.i. min. rising to 80-90 p.s.i. at normal running speeds. Care must be taken to allow the oil temperature to reach 50°C before exceeding 7,000 r.p.m. otherwise bearing failure may occur due to running at high speed with cold oil.

Max. permissible oil temperature is 100°C, measured in the tank.

If the oil pumps are dismantled for any reason, it is essential to check that the shaft turns freely on re-assembly before fitting to the engine. If it is not possible to turn the shaft easily, then the drive gears may suffer. Any dirt in the pumps will have a similar effect.

Oil Filter Element Part No. PP 0404.

Cooling System - See Drawing BA 0383

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

Breather System

Cosworth BDD Atlantic heads have been modified to suit our breather system and it will be noticed that an extra tube has been welded to the front of the cylinder head and that the front breather tube pressed into the head is longer than standard.

It will therefore be necessary to modify the standard B.D.A. front cover by machining a 10.8 mm dia. hole (BA 0402) parallel to the existing breather tube, in the boss adjacent to the normal breather tube. Fit BA 0268 Oil Drain Tube into this hole leaving .75 in. of the tube above the face of the boss. Connect this tube to the tube welded onto the head, and connect the larger breather tubes in the normal way. It is also recommended that the rear cylinder block to head breather is blocked, using BA 0390 bung in the block and core plug PP 1123 in the head, and that the rear cylinder head oil drain in the block is restricted.

COSWORTH BDDBOLT TORQUES

Flywheel/Crank (12 Bolt)	3/8	UNF	50-55 lb. ft.
* Big-End			41-42 lb. ft.
Cyl. Head (Soc Cap HD)	7/16	UNC	62-65 lb. ft. (oil under head)
Main Cap	7/16	UNC	65-70 lb. ft.
Cam Pulley	3/8	UNF	20-25 lb. ft.
Jackshaft Pulley	5/16	UNC	15-20 lb. ft.
Jackshaft Pulley BA 0509	3/8	UNC	20-25 lb. ft.
Idler Pulley Nut/bolt	7/16	UNC	30-35 lb. ft.
Crankshaft Pulley	7/16	UNC	35-40 lb. ft.
Cam Carrier/Head	1/4	UNC	8-10 lb. ft.
Water Pump	5/16	UNC	16-18 lb. ft.
Plugs	14	mm	14-16 lb. ft. Graphite grease on threads.
Other			
1/4 Bolts (sump, front cover etc.)			5-7 lb. ft.
5/16			10-15 lb. ft.
3/8			20-25 lb. ft.

* Should be fitted with engine oil on threads and Molybdenum disulphide anti-scuffing paste under head.

COSWORTH BDDRunning-in

Standard running in procedure on a dynamometer is as follows:-

<u>Torque</u>	<u>Rpm</u>	<u>Time</u>
44 lb. ft.	3,500	To full oil pressure
52 lb. ft.	4,000	30 min.
70 lb. ft.	4,500	30 min.
88 lb. ft.	5,000	30 min.
105 lb. ft.	5,500	30 min.

Then inspect tappets and test.

Rev. Limits

Recommended Limit = 9,000 rpm.

In first and second gears 8,500 rpm is suggested as maximum, since due to tacho reading lag it is quite easy to exceed 8,500 rpm in low gears even though a chronometric tacho may show well under 8,500 rpm.

The engine should not be allowed to idle at under 2000 rpm or excessive cam and tappet wear will be experienced.

See also note under Oil System above.

Related Drawings:-

- BA 0440 - Engine General Assembly (2 sheets)
- BA 0285 - Oil System
- BA 0383 - Cooling System
- BA 0498 - Ignition Circuit Diagram
- BA 0137 - Exhaust Flange
- FA 0289 - Assy. Crankshaft Bung.

COSWORTH BDDPISTONS PA 0092 - 1600 c.c.

Gap on all rings should be .015/.022 in. when fitted in the bore.

Pistons are normally supplied with gudgeon pins ground to the correct length and circlips ground flat and parallel. Circlips should be fitted with ground face outwards and gudgeon pin end float should be .001 in. interference to .001 in. clearance when measured at room temperature.

It will be necessary to do a trial assembly to check the position of the piston crown relative to the top face of the block at T.D.C. The pistons should be .004/.006 in. down the bore at T.D.C. so the piston crowns will need machining so that this is achieved.

Exhaust System:-

4 x 1 7/8" O/dia. x 27" into
1 x 2 1/4" O/dia. x 28"
All pipes to be 18 SWG Tube.

Carburettors:-

48 DCOE
42 Choke
180 Main jet
200 Air jet
F9 Emulsion tube
Modified Venturi
Trumpets - modified 50 DCOE's
Adaptor plates - manifold / Carb. 45 DCOE
Max. fuel pressure to be 3 P.S.I.

COSWORTH BDDBD CYLINDER BLOCKS

The cylinder block should be finally cleaned before assembly. Main oil gallery bungs and the cam carrier/cam shaft oil feed restrictor can then be fitted. The restrictor, part number BA 0356, should be fitted flush to just below the cylinder block top face.

