

B.D.R.

BDR Conversion of the standard Ford 1600cc crossflow Kent engine 120, 150, 160, and 170 BHP versions.

It is recommended that a "Hayes" manual for the Mexico/RS/1600 engine is purchased.

Performance. The performance figures stated for the four versions of the BDR are achieved with good flexibility. Whilst it is relatively easy to improve the performance beyond 170 BHP this should not be attempted with the standard crankshaft and connecting rods which should be limited to 6250 R.P.M. The braking, road holding and tyres of the car to receive the BDR should be in keeping with the engine performance. Due to a build up of scale the radiator may not be adequate to cool the BDR.

The engine to be converted should be completely stripped, cleaned and inspected. Replace any defective or worn parts. To define right or left had side of engine view from rear of engine forward.

Cylinder Block. The used cylinder block should be thoroughly cleaned after removing plugs. Teapot spout brushes are ideal for scrubbing galleries. Do not use rag wipers which tend to leave behind a residual of fluff.

Drill water transfer holes in top face of block if necessary. (see fig. 1.) The top face of block should be flat, if necessary re-surface, removing minimum material to achieve a flat surface.

Check grades of pistons to be fitted and hone bores accordingly. If the bores are already oversize sleeve back to standard using standard Ford liners or bore and hone to suit the 1700 cc high compression optional pistons.

Fit cylinder head oil feed restrictor in top face of block. (see fig. 1.)

The oil bleed hole for the chain lubrication on the standard engine to be blocked off using 1/16" diameter aluminium wire. This hole is situated just above main bearing housing on front face of block. Blank off cylinder head/block breather holes with PP1123 and BA0390 core plugs.

Front cover. First fit breather and oil drain tubes (7/16" and 3/4" diameter) into respective holes in cover using Araldite. Both tubes should protrude approximately 3/4". Then fit both oil seals flush with casting.

Cover alignment is achieved by pushing jackshaft and crankshaft pulleys into seals on respective shafts before tightening front cover bolts. Bottom joint face of cover should be flush with sump joint face.

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Crankshaft. It is not recommended that a crankshaft which has been reground undersize on journals is re-used. Reject a standard crankshaft which has seen excessive service in its original application. Crack detect before having crankshaft tufftrided. With fine emery paper lightly polish journals and thoroughly clean. We recommend fitting Vandervell lead Indium main and connection rod shells. Some standard cylinder blocks are manufactured with main bearing housings line bored +.015" oversize, check before purchase.

Crank, clutch and flywheel should be balanced.

Connecting rods. Crack detect and check balance, fit new bolts, standard on 120 BHP version, TA0083 on 150, 160 and 170 BHP versions. Fit and torque bolts with engine oil on threads and under bolt head.

Jackshaft. A groove must be machined in the front bearing journal of the standard Ford camshaft as shown on fig. 2. Ignore existing slot. The groove provides a continuous oil feed to the camshafts metered by restrictor shown in fig.1.

Oil pump. Upgrade oil pump by fitting pressure relief valve spring provided (PP2712) in place of standard Ford one. Renew oil filter.

Water pump. Re-condition if necessary. Remove standard hub and fit BA0031 hub.

It may be necessary to remove rib on water pump casing to give extra clearance between water pump and main drive belt.

Cylinder head. To achieve the 150, 160 and 170 BHP performance versions. It is necessary, to evenly blend, by fettling, the inlet port from the .850" dia. to the 1.01" dia. seat throat. The exhaust port from the .850" dia. to the .850" dia. seat throat.

Remove any cast port flash or imperfections.

Match inlet manifolds to cylinder head inlet port.

Lap in valves and assemble spring platforms, spring retainers and cotters, make sure cotters are well home in the grooves. Fit water outlet connector from original head.

Camshaft carrier. Take care not to raise any burrs when fitting BA0017 head to camshaft carrier ring dowels.

Camshafts. The inlet camshaft has wider spaced lobes than the exhaust camshaft. Polish all journals with oiled fine emery paper. Remove any snags from the camshaft thrust key grooves. Remove sharp edges on sides of cam lobes.

Timing. Set up camshaft pulleys as in "Hayes" timing diagram (page 52) with timing marks in the centre on a horizontal line through camshaft centrelines. Turn crankshaft until No.1. piston is at top dead centre on the firing stroke. Jackshaft pulley timing mark should now be coincident with a line through jackshaft and crankshaft centrelines. File a new mark on crankshaft pulley along this line next to jackshaft timing mark. Ignore any existing mark on crankshaft pulley.

Timing belt. Always refit belt to run in the same direction. With all the slack on the longest free run adjust tension so that it should just be possible to twist the belt through 90° by hand.

Tappet adjustment. Rotate engine forwards to T.D.C. (camshaft pulley marks lined up). Remove camshaft belt having slacked off eccentric pulley to remove belt tension. Retain tappets up against the camshafts, preferably by inserting 8 EA0153 tappet holding clips between adjacent tappets. Remove surplus oil from tappet chambers with a syringe. Slacken off hexagon head bolts, ensuring cam carrier lifts evenly. Carefully lift carrier assembly vertically until clear of valve stems and shims. Some shims may stick to tappets, some to valve stems, it is therefore advisable to stick the shims to the valve stems with grease whilst carrying out tappet adjustment. It is beneficial to have a set of thin "slave" shims so that the shims in the kit can be finished ground at first attempt. When grinding tappet shims to size the tappet surface should be flat and parallel to the valve stem surface.

Carburettor adjustment. Carburettors should be flexibly mounted and have approximately 10 mm total movement at the trumpet in the vertical plane.

Fuel pressure. In our experience there is a drastic variation in the fuel pressure delivered by pumps of the same type. Maximum fuel pressure of 2½ to 3 p.s.i. can be achieved by fitting fuel pressure regulator KK0271 between pump and carburettors.

Alternator. It will be necessary to mount the alternator forward of its original position. Some bracketry might be available from Cosworth.

Flywheel and clutch. Use either standard RS1600, RS1800 or Lotus Cortina flywheel and clutch with suitable clutch bell housing. 105E Anglia type suits most gearboxes. Lightweight special vehicles like the Lotus and Caterham 7 could make use of the current Escort Sprint flywheel, which will benefit by lightening, with AP driven plate HB2427/1283c and cover 76649/22P/T4782.

Ignition distributor. Check condition, in particular shaft rock. Lucas preferred, side entry cap if possible to find.

Ford 116E 1500 cc and Lotus Twin cam conversions. The BDR kit, less pistons is suitable for converting the above engines. Given suitable demand Cosworth will manufacture forged pistons to suit 83.5 mm bore (1600cc).

Ford 1300 cc Kent Crossflow engine conversions. Most of the BDR kit is suitable for the above conversion. Shorter timing belts and larger idler pulleys are available to suit the short 1300 cc cylinder block. The distributor body and shaft would require shortening and a side entry distributor cap used to achieve clearance between distributor cap and inlet manifolds.

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Exhaust system. Where it is not possible to use the RS1600 or RS1800 exhaust manifold a special will need to be fabricated.

See exhaust flange drawing No. BA0137 - Three stud fixing
or BA0722,3,4 - Four stud fixing

Spark plugs

120 BHP Champion N9Y
150/170 BHP Champion N7Y

For sustained high speed use we recommend a racing plug.

BDR Engine details

Main bearing diameters 2.1260/2.1255
Crankpin diameters 1.9375/1.9370

Valve timing BD1 120 and 150 BHP and BD3 160 and 170 BHP

Inlet valves fully open $110^{\circ} + 1^{\circ}$ ATDC
Exhaust valves fully open $110^{\circ} + 1^{\circ}$ BTDC

Valve lift

BD1 120 and 150 BHP .335"
BD3 160 and 170 BHP .340"

Tappet clearance measured cold

BD1 120 and 150 BHP .008/.009 inlet .011/.012" exhaust
BD3 160 and 170 BHP .008/.009 inlet .011/.012" exhaust

Ignition

Firing order 1-3-4-2
Ignition $18^{\circ} - 20^{\circ}$ fully advanced

Before removing sparking plugs, clear all dirt from recess. Use special pliers to remove H.T. leads - do not pull directly on leads.

Cylinder head bolts. 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

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. Always adjust with a cold engine. When checking timing marks or timings always turn the engine in its normal direction of rotation, with the belt correctly tensioned.

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Cooling system. Add a "Barseal" capsule to the cooling system when the engine is fitted in the chassis. In cold weather the usual precautions should be taken against freezing.

Bolt torques

Flywheel/crank	3/8 UNF	50-55 lb.ft.
Big end (TA0083)	3/8 UNF	41-42 lb.ft. (oil on threads and under head)
Cyl. head	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.
Idler pulley nut	7/16 UNC	30-35 lb.ft.
Crank 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	14mm	14-16 lb.ft.

Other

1/4 bolts	5-7 lb.ft.
5/16	10-15 lb.ft.
3/8	20-25 lb.ft.

Rev. limit 6250 RPM

Carburettor settings. Engine testing at Cosworth has been carried out using 4 star approx. 97 octane pump gasoline, which has a high lead content compared to many other countries. It will probably be necessary to vary carburettor setting recommendations outside the u.k.

120 BHP 40 DCOE

30	choke
125	main jet
200	air jet
F16	emulsion tube
35	pump jet
45F9	slow run jet
200	needle valve and seat

150 BHP 40 DCOE

32	choke
120	main jet
170	air jet
F11	emulsion tube
40	pump jet
45F9	slow run jet
200	needle valve and seat

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160 and 170 BHP 45 DCOE

38	choke
140	main jet
160	air jet
F16	emulsion tube
45	pump jet
45F9	slow run jet
250	needle valve and seat

choke and jet settings may vary from one application to another.

Maximum fuel pressure 3 p.s.i.

It is not necessary to match inlet manifolds to head and manifolds or adaptor plates to carburettors. The manifold to carburettor adaptor plate 'O' ring will swell in use and once unclamped will not fit back in their grooves until a "drying out" period has been allowed, therefore keep spares or do not unnecessarily remove carburettors from manifolds.

A Cosworth air filter to suit most applications can be supplied.

Oil feed to cylinder head at front R.H.S. of block to be reamed $21/64$ " dia. and restrictor BA0356 fitted as shown.

Four water transfer holes in R.H.S. of block top face to be drilled if not already present. Lay gasket on top of block and mark centres for four $5/16$ " dia. holes offset as shown. At $.75$ " depth these will break into water jacket.

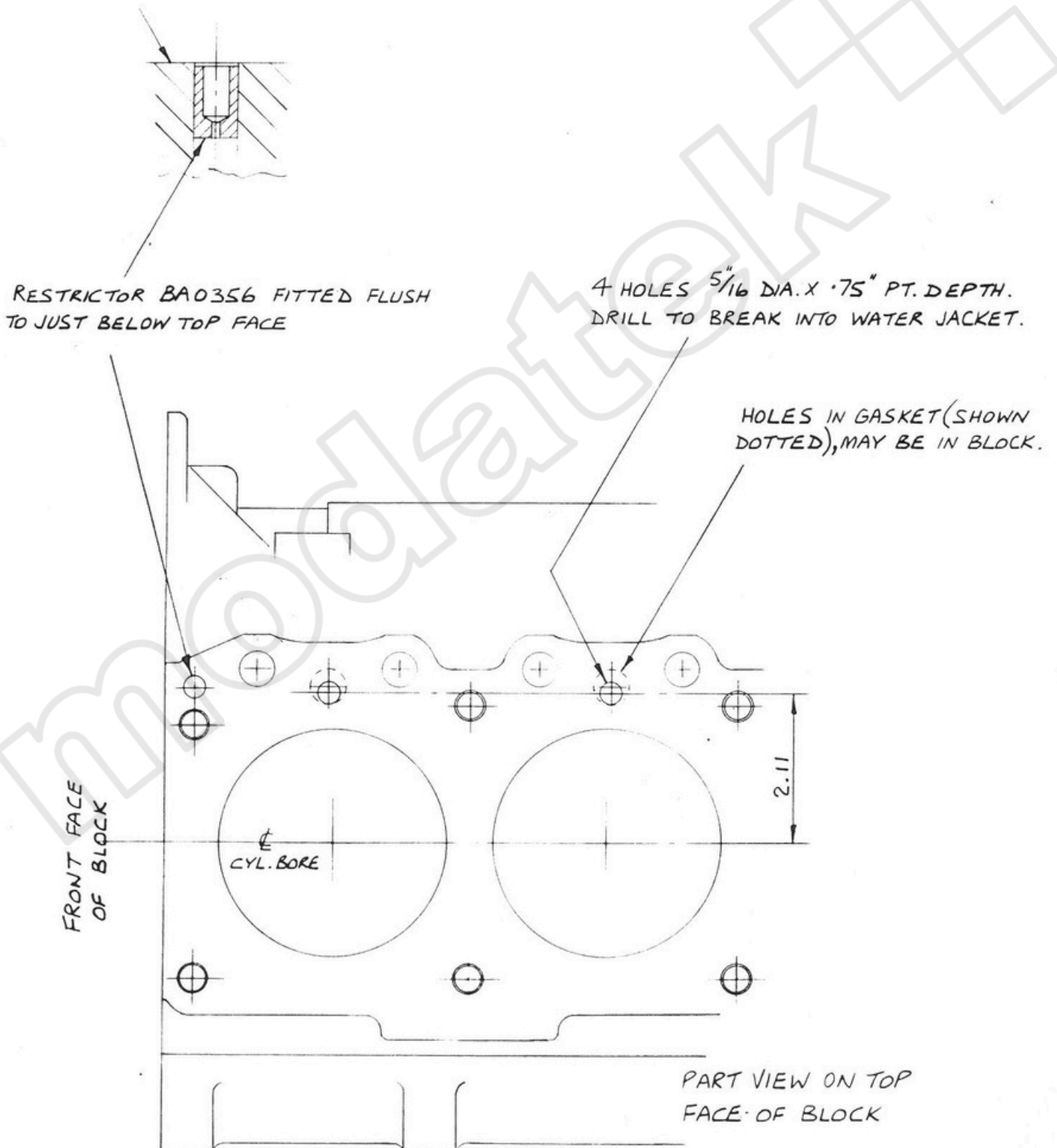


FIG. 2.

