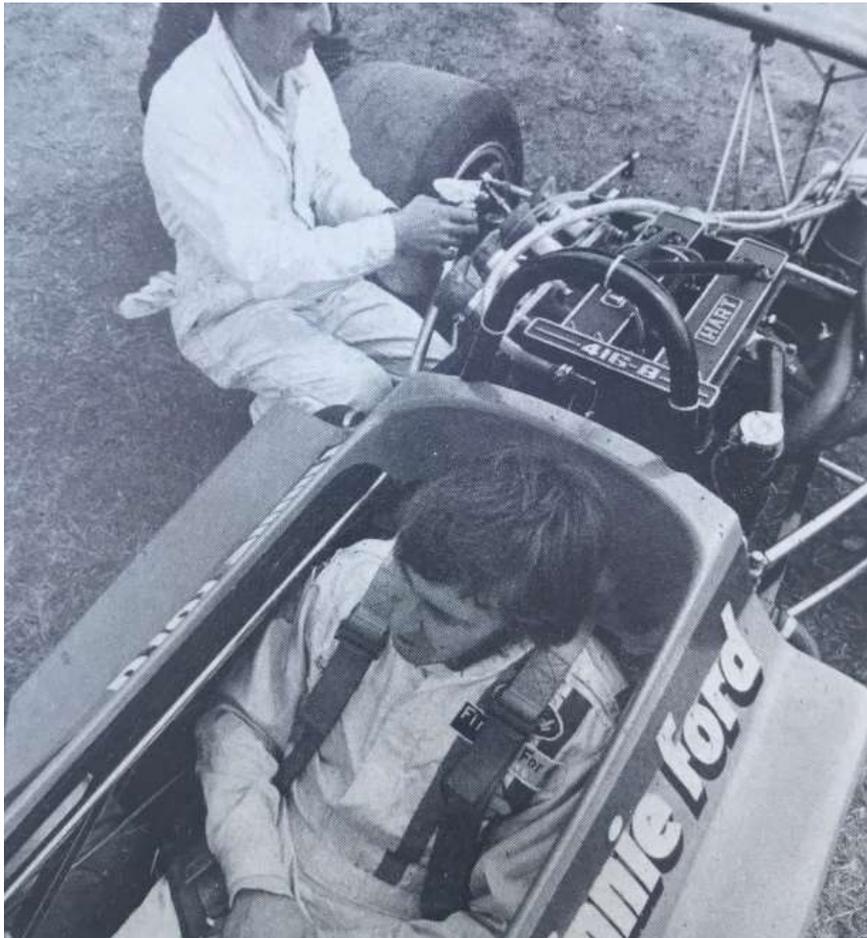


Hart 416B Small valve and Big valve

Hart with the 416B engine produced what was recognised at the time in the early 70's as the ultimate racing Twincam engine. These were substantially more modified with much bigger porting and bigger valves (1.7inch inlet and 1.45inch exhaust in the big valve version) that were recessed into the head further to provide clearance on overlap and modified combustion chamber to accommodate these recessed valves and the head milled down to well under standard Big Valve head 4.600inch thickness to help restore compression ratio in combination with the intruders used on the piston. Porting was taken to the extreme with the inlet ports often breaking through into the spring pocket bases and the crack being filled up with epoxy.



Some further details on the Hart 416B engine courtesy of Tim Wilkes follow

The 416-B Twin Cam Engine: Brian Hart developed a race version of the Lotus Twin Cam engine - the 416-B; by 1972 he was getting 190 bhp out of it. Some were small valve versions (1.625" intake & 1.375" exhaust), most had big valves (1.69" intake & 1.44" exhaust); some had iron blocks, some had alloy. At first they breathed through twin Weber 40 or 45 DCOEs: with short trumpets, maximum revs were 8500; for the alloy block version the maximum revs were 9250 with long trumpets. Later he developed the Lucas fuel injection system for the engine. Hart 416-B engines were popular in the USA and Australia for the US Formula B and Australian F2 during the 1970s. Engine spec's for a 1973 416-B with iron block were 200 BHP min @ 8500 RPM, torque of 130 lbs/ft max @ 7500 RPM; for a 1974 with an alloy block they produced 200 BHP min @ 8500 RPM, torque of 125 lbs/ ft @ 8500 RPM. The engine was fitted as original to the Brabham BT40. In his book, Miles Wilkins wrote that 'Hart managed to extract around 200 bhp from an all alloy block TC in 1974'.

Below is an original specification sheet:

BRIAN HART LTD.	RACING ENGINE DESIGN DEVELOPMENT & OVERHAUL
	4, SOUTH PLACE, TEMPLE FIELDS, HARLOW, ESSEX. TELEPHONE: HARLOW 2287 YOUR REF. OUR REF. DATE
<u>'72 SPECIFICATION</u>	
<u>TYPE 416 'H' - 190 b.h.p. MINIMUM TWIN-CAM DRY SUMP RACING ENGINE</u>	
190 b.h.p. minimum at 8,000 r.p.m. maximum torque 135 lbs/ft. at 6,600 r.p.m.	
<u>CYLINDER BLOCK</u>	Steel capped - thick wall block bored 83.5 μ m. 3.2830" diameter. main bearing bolt torque 63lbs/ft.
<u>CRANKSHAFT</u>	Nitrided steel, running in $\pm .015$ " c/a. bearings no. 4478. Standard thrust washers.
<u>CONNECTING RODS</u>	Cosworth steel rods (big end bolt torque 42 lbs/ft. oil threads). Bearing No. 4088.
<u>PISTONS</u>	Special forged Mahle racing pistons - 2 plain compression, 1 oil scraper ring.
<u>CYLINDER HEAD</u>	Modified Lotus. Compression ratio 12-1 maximum. Head bolt torque 55 lbs/ft. minimum. Special, re-inforced head gasket fitted.
<u>VALVES</u>	Inlet - 1.70" dia. Exhaust - 1.45" dia.
<u>SPRINGS</u>	Special selected - fitted length 1.30" \pm .010".
<u>RETAINERS</u>	Special modified, and must be used with above springs.
Contd./.....	
DIRECTORS: B. A. HART, D. E. HART, L. ADRIANO	

CAMSHAFTS

ZL.16 - special steel tappets also used.

Valve timing:

Inlet valve fully open 102° A.T.D.C.

Exhaust " " " 102° B.T.D.C.

Tappet clearances - inlet & exhaust $.007''$ - $.008''$ measured cold.

CARBURETTORS

Twin 45 DOBE Weber carburettors

40 w/a. Chokes)
160 Air corrector) This can vary
160 Main jet) per engine
716 Needle)
45 Pumps)

45 F 9 I D L E

CLUTCH & FLYWHEEL ASSY.

Special all steel flywheel. Single plate
Borg and Beck clutch (to suit VT.200 Howland gearbox)
Flywheel torque 50 lbs/ft. Clutch bolts 13-15 lbs/ft

DISTRIBUTOR

Lucas racing type - special points. Ignition set at
 33° B.T.D.C. total advance. Contact breaker gap $.015$

SPARKING PLUGS

Autolite AG.701 or AG.501 \leftarrow C-110
Lodge EL49
Champion N557, G 2, N596

It is important that when fitting Autolite plugs,
that 2 copper washers are fitted.

OIL PUMP

Brian Hart Limited dry sump oil pump.
Minimum pressure 70 p.s.i. at 85° C.

Maximum continuous revs 8,300
Maximum revs 8,800

OIL TANK
 SHOWN IN AS TALL AS
 POSSIBLE. 2 GALLON CAPACITY
 CONTAINING 1/2 GALLON HEAVY
 GAUGE FILTER ON CENTER TO
 PREVENT PRESSURE LOSS.

SCREW, PIPE AND NUT
 PART NO. 74 0070
 FROM CAUSE FILTER
 IN SUMP ORIENT
 (INCORPORATED IN
 COMBOTH SUMP)

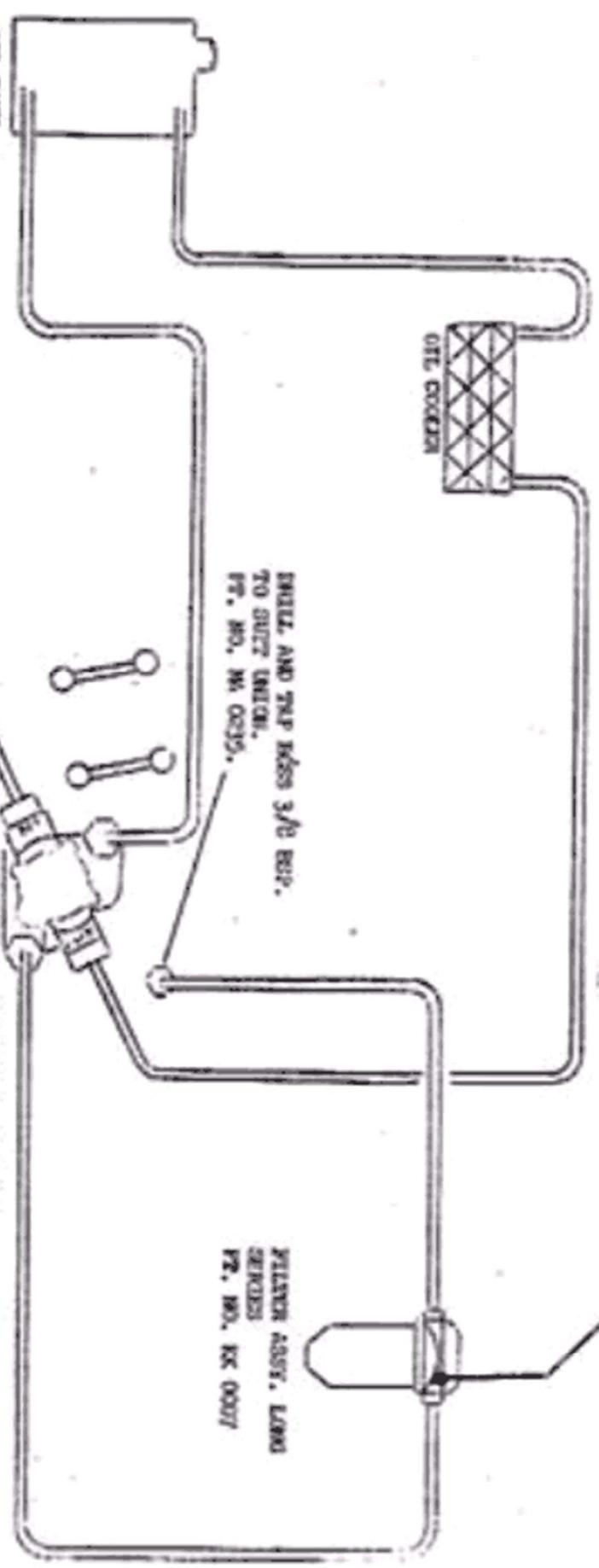
OIL PRESS. AND SCAV. PUMP ASST.
 PART NO. KX 0002 AND KX 0003

WELDED STEELWORK SHOWN ALL
 CONNECTING PIPES TO BE 1/2"
 BORE BEECH PIPE
 PART NO. LZ 0008 (QUOTE LENGTH
 REQUIRED).

BUILD AND TAP INDS 3/8 BSP.
 TO SUIT UNIT.
 PT. NO. M 0015.

FILTER ASST. LOAD
 SERVIC.
 PT. NO. KX 0007

OIL PRESSURE GAUGE
 PT. NO. PV 0011 OR PV 0012



TYPICAL LOTUS TWIN CAM VALVE SIZES (inches)

	Intake	Exhaust	EX%
Standard Engine	1.53	1.32	86
Big Valve Engine (Stromberg)	1.56	1.32	84
"Racing" Engine	1.625	1.375	84
Brian Hart Engine	1.690	1.44	85

The Hart head had really deep breathing capabilities. A lot more CFM overall and great intake flow up to 0.450" lift with the exhaust good to 0.400" According to Dave Bean, when everything was set perfectly, a Hart TC had about a cigarette paper width between the valves as they passed on the overlap! However, the cams had 500 thou lift and ~330 degree duration with 1.69"/1.44" valves. Hart racing heads were very thin as the valves were moved back into the head to prevent them hitting each other. To keep the compression ratio up the head face was heavily machined. The ports should be very big also with a shallow inside bend on the inlets compared to a stock head.



