CYLINDER BLOCKS, CRANKCASES AND CAMSHAFT CASINGS

The three cylinder blocks are identical light alloy castings and their use as 'A', 'B', or 'C' block is determined by the fitting of various vent connections and drain connections. Coolant circulation passages are formed in each casting and are connected to jackets, formed by the casting, around the removable stool cylinder block mounting faces. The high tensile steel through bolts of which there are nineteen in number in each block, are threaded at each end. Slotted nuts, which are split pinned in position are screwed onto the threaded ends of the bolts and are torque loaded.

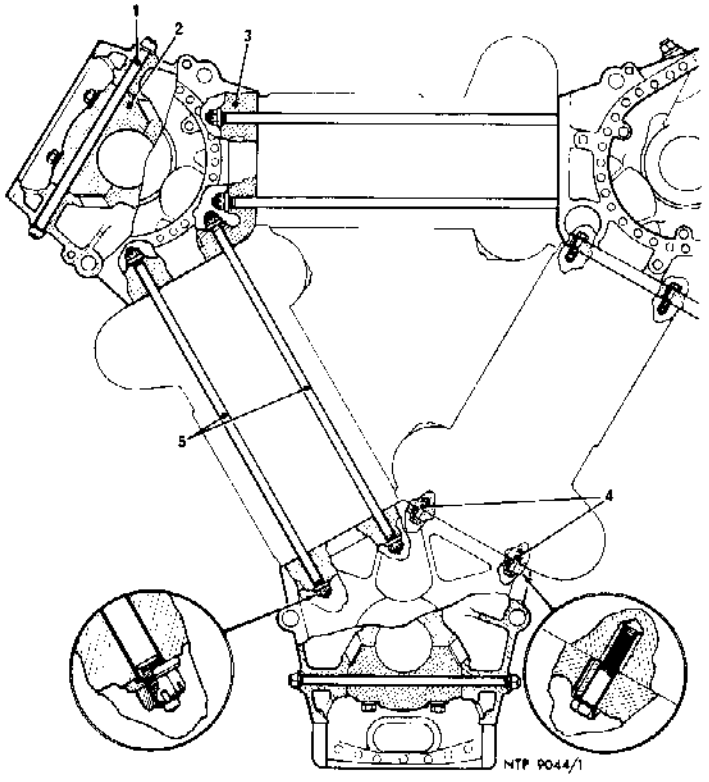
Air inlet ducts, connected to the blower volute casing, are cast along both sides of each block, the ducts are provided with drain points to enable any accumulation of fluids to be drained away. A machined mounting face is formed on the outside of the block lying parallel with the air inlet duct. To this face the water cooled exhaust manifolds is secured on studs, by nuts and spring washers, a copper and asbestos gasket forming the joint between the manifold and the mounting face on the cylinder block. The air inlet ducts and the exhaust manifold communicate with the respective ports in the cylinder liners through chambers, formed in the cylinder block round the liners.

Between the air inlet duct on the outward side and the exhaust manifold mounting face on each block a further machined mounting face is provided for the attachment, on studs, of a camshaft casing. Dowels are positioned at the free end and drive end of this face to provide correct location of the camshaft casing.

Apertures are provided on the outward side of the cylinder block for adapters which carry the fuel injectors. These apertures lie between the camshaft casing and exhaust manifold mounting faces.

As with the majority of the main assemblies, the mounting faces between the cylinder blocks and crankcases are face to face joints, which during assembly are lightly smeared with a jointing compound.

When the main triangle assembly of the three crankcases and three cylinder blocks is assembled, a mounting face is formed on the free end of the three cylinder blocks, to which is secured a sandwich piece. This sandwich piece mounts on its free end face the turbo blower and provides a measure of support to the free end of the main assembly. The sandwich piece has cored passageways which align with the coolant outlet ports at the free ends of the cylinder blocks and one final outlet which lies on 'A' side of the casting. Apertures are provided in the casting which align with the air inlet manifolds of the three cylinder blocks and with the volutes of the scavenge blower. Dowels positioned in the mounting faces of the blocks correctly locate the sandwich piece.



1. Crankcase tie bolt
2. Main bearing cap
3. Crankcase
4. Crankcase to cylinder block set bolts
5. Through bolts

ARRANGEMENT OF THROUGH BOLTS

Cylinder Liners

The steel cylinder liners are of the wet type, the engine coolant being in contact with their outside surface. The liners are chromium plated in the bore to provide a hard wearing surface. The external surface of the liner is machined to provide a number of lands which, when mating with the bore of the cylinder block, form annular cooling jackets around the liner. Synthetic rubber sealing rings are located in machined recesses on each of the above mentioned lands and prevent leakage of coolant into the gas ports and from the ends of the liner. The cooling jackets adjacent to the exhaust ports are connected by axial holes drilled through the exhaust area land, known as the exhaust muff, and through the port bars. The combustion area of the liner is surrounded, on the external surface of the liner, by a large land which has a number of coolant guide vanes machined on it.

There are nine exhaust ports machined on the muff area at one end of the liner, around part of the circumference, while the other end of the liner has fourteen inlet ports formed equidistant around the whole circumference. The external surface of the liner is tin plated to resist corrosion except for the exhaust muff area and the external combustion zone which are flash chrome plated to resist the corrosive effects of carbon deposit, and to obviate the effects of cavitation errosion respectively.

The liners are a shrink fit into the cylinder blocks and are retained against a flange in the cylinder block casting by a ring nut screwed to a thread formed on the inlet end of the liner. This provides the axial location of the liner, the angular location being provided by the injector adapter and a blanking plug which pass through apertures in the cylinder block and screw into tapped holes in the liner. If air starting equipment is fitted to the engine, the blanking plug positions in one block are occupied by air starting valves.

Crankcases.

The three crankcases are one piece light alloy castings basically similar in construction. Each crankcase is bolted to the adjacent cylinder blocks along two faces machined at 120°, and the outward facing side is closed with a light alloy cover giving access to the main and big end bearings. Stiffening webs are cast inside each crankcase, and a transverse high tensile steel tie bolt passes through each web and main bearing cap. Passageways for conveying lubricating oil to the main bearings, are cast in the crankcase walls and webs.

A compartment, formed between the drive end web and the drive end of the crankcase, houses gear trains which are driven by a gear secured to each crankshaft. These gear trains drive the fuel injection pumps camshafts (one from each crankshaft), the turbo blower (from 'AB' and 'BC' crankshafts), and the auxiliary gearbox (from the 'CA' crankshaft).

Each crankcase has a machined face formed at the driving end to which is mounted the phasing gear case. The main triangle assembly and the phasing gear case are joined on these three crankcase faces by a face to face joint smeared with a jointing compound and secured together by a large number of

studs and nuts.

The two top crankcases, 'AB' and 'BC' are alike, but are handed during manufacture by the interchanged positions of the oil drain manifold, and the main oil gallery connections and by various changes in oil drillings. Thus these crankcases are not interchangeable. The oil drain manifolds are secured on studs on the 'A' and 'C' side faces of the two crankcases and provide a means of draining the crankcases of oil, the manifolds being connected, at their drive ends, by means of external flexible pipes to 'CA' crankcase.

The top two crankcases are closed at the free end by a removable cover which partly surrounds the damper secured at the free end of the crankshafts.

Both crankcases carry plain bearings for the blower flexible drive shafts in the angle between the cylinder block mounting faces, the crankcase webs having housings formed in them to carry these bearings.

Two of the four engine lifting positions are sited on these two crankcases, lifting eyes being secured in bosses at the free end of each crankcase. These lifting eyes should remain in position. The other two lifting eyes are secured to the phasing gear case. These lifting eyes are designed to take a vertical lift only and the makers engine sling should always be used when lifting the engine.

The bottom crankcase is dissimilar in appearance to the top two, being much deeper in cross section to provide a sump for drain oil. As with the top two crankcases, a flexible drive shaft is carried in plain bearings housed in the crankcase webs. This shaft provides the drive for an auxiliary gearbox which is secured at the free end of the bottom crankcase.

The bottom crankcase cover which also closes the bottom of the auxiliary gearbox is provided on 'C' side with a drain connection. On some engines this takes the form of a pipe to which a hand pump can be connected to pump oil from the bottom crankcase. On other engines a drain cock is provided. A drain plug is situated at the lowest point of the cover for draining residual oil.

The auxiliary drive gear box which closes the free end of the bottom crankcase provides mounting faces and a drive for the coolant circulating pump and for a sea or raw-water pump when fitted. On certain installations a power take-off point is provided. The free end engine mounting feet are secured to machined faces on either side of the gearbox.

Main Bearings

Vandervell thin-wall bearings support each crankshaft. Each bearing comprises two steel half shells lined with lead bronze, lead coated and indium infused. The properties of indium infusion lend to the lead coating a degree of inhibition against any corrosive effects of detergent oils.

One half bearing is located in a housing machined in each crankcase web and is held in place by a bearing cap containing the other half bearing.

To prevent spinning, the bearing shells are provided with 'ears', the ears on the case half bearing abut the bearing cap while those on the cap half bearing abut the crankcase web. The bearings are drilled and grooved to pass oil from ducts in the crankcase webs to the crankshaft journals.

The main bearing caps are secured in position on four studs by plain nuts which are torque loaded. To prevent the studs from turning in the casting, when the nuts are being tightened, adjacent studs are locked together by an anti-torque plate. The bearing caps are a push fit into the crankcase webs and are drilled to accept the crankcase transverse tie bolts. Location of the bearing caps is achieved by two hollow dowels which are located in the bearing cap and which mate with holes in the crankcase web surrounding two of the cap studs.

The transcerse tie bolts of the crankcase are torque loaded into position and add to the strength of the crankcase walls by 'nipping' the fit of the main bearing caps to the crankcase webs. Thus the main bearing caps virtually form solid bridge pieces across the crankcase.

Two thrust half washers, positioned one on either side of the centre main bearing support webs in each crankcase, provide for the axial location of the crankshaft. These half washers are formed on the same principle as the main bearings, thus, they are steel backed, lead bronzed, lead coated and indium infused.

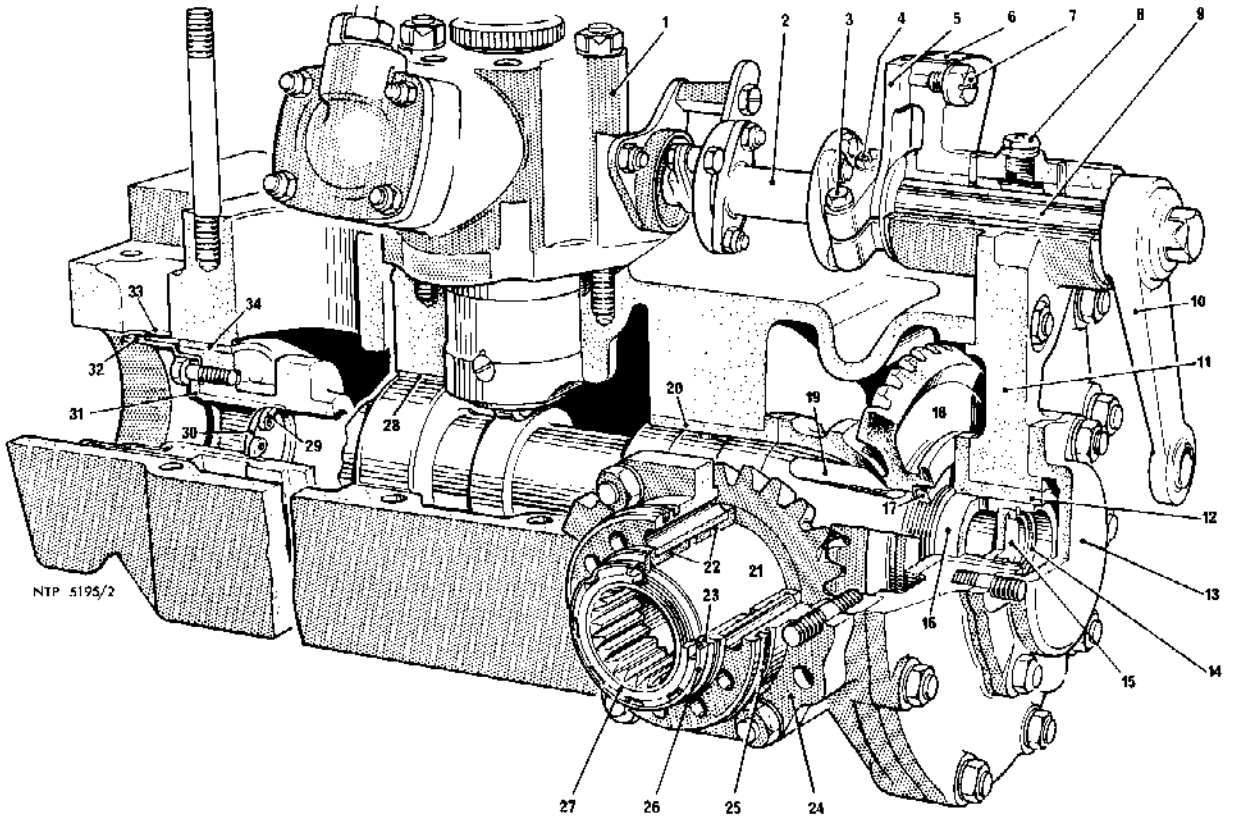
Camshafts Casings

The camshaft casings are mounted on machined faces on the outside of each cylinder block, being correctly located in position by dowels and secured on studs by nuts and spring washers. Each casting has machined faces for mounting the injection pumps and, at the driving end, for the camshaft drive casing and the end cover. The casing end cover incorporates a tail bearing for the camshaft and a bearing for the fuel injection pumps control shaft. Cast within the camshaft casing are housings which carry the camshaft bearings, and a gallery is drilled the fuel length of each side of the casting for the circulation of fuel to and from the pumps.

Each camshaft is supported in white metal lined phospher bronze bearings, these bearings being lubricated from inside the hollow camshaft. The camshafts are driven from the adjacent crankshaft gear through a train of spur and bevel gears in each crankcase, two mating bevel gears are located in each camshaft casing one of which is keyed to the camshaft. The drive from the crankcase gear train is passed to the bevel gears within the camshaft casing by a short quill-shaft having a vernier number of parallel splines at either end. This vernier combination permits adjustment when timing the camshafts. A split tubular casing encloses the quill-shaft, oil leakage being prevented by rubber sealing rings at either end, the rings being located in the crankcase and camshaft casing respectively.

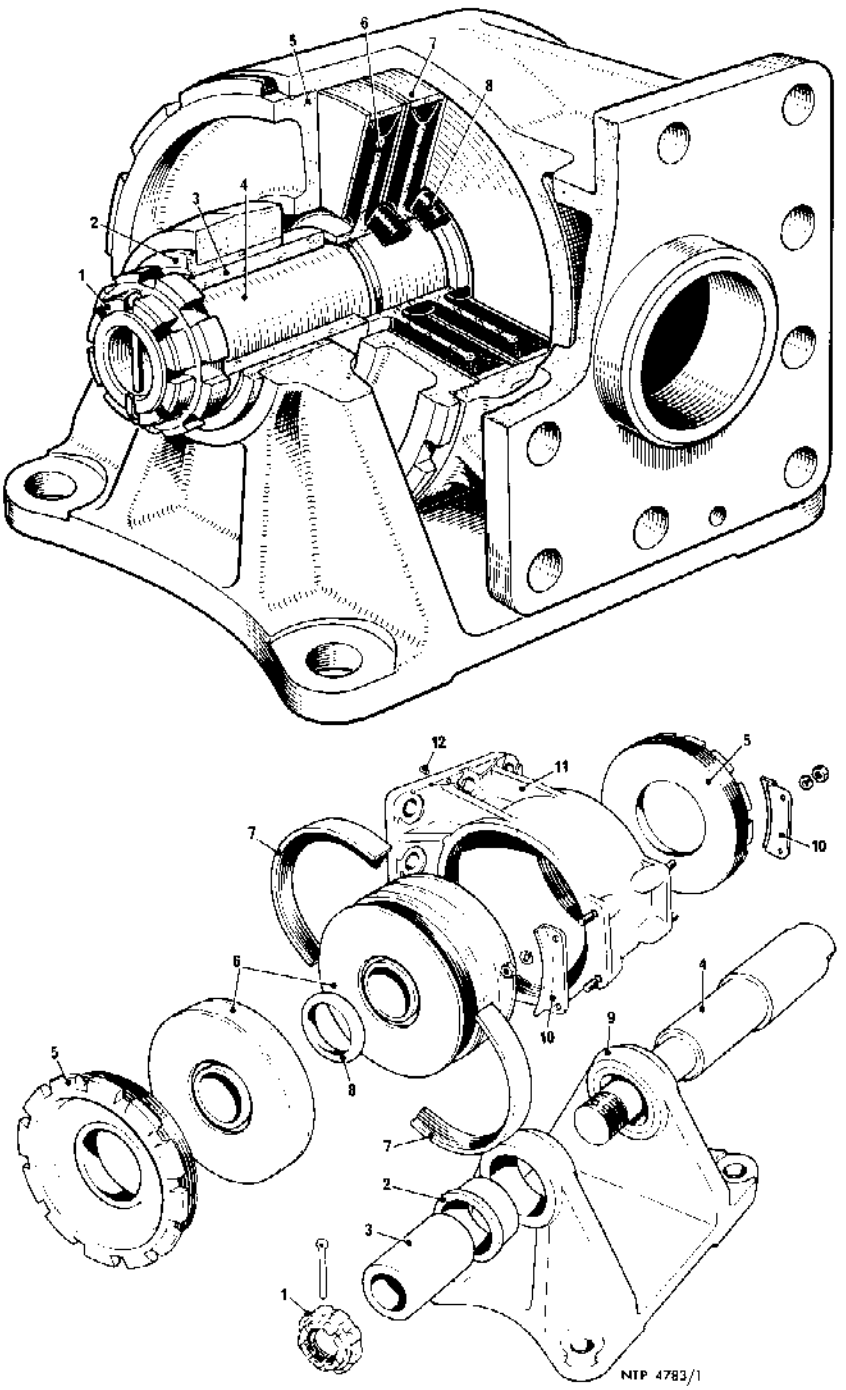
Engine Mounting Feet

The engine is supported on four mounting feet which are of the suspension unit type. The units comprise a bottom bracket, which bolts to the engine bearer struts of the installation, and a housing assembly containing the



1. Fuel injection pump
2. Interconnecting control shaft
3. Locking bolt
4. Worm adjuster
5. Indicator arm
6. Scale
7. Serring pin
8. Grease nipple
9. Control shaft
10. Control lever
11. End cover
12. Tail end bush
13. Cap
14. Circlip
15. Plug
16. Camshaft
17. Ring nut
18. Bevel gear
19. Key
20. Camshaft bush
21. Bevel gear
22. Bevel gear bushes
23. Washer
24. Bevel gear housing
25. Seal ring
26. Lock washer
27. Ring nut
28. Camshaft bush
29. Circlip
30. Plug
31. Splined coupling
32. Timing collar
33. Timing datum mark
34. Camshaft free-end bush

CAMSHAFT ASSEMBLY



1. Ring Nut
2. Bush
3. Sleeve
4. Mounting Pin
5. Retaining Nuts
6. Suspension Units
7. Split Rings
8. Rubber Rings
9. Bottom Bracket
10. Locking Plates
11. Housing
12. Dowel

ENGINE MOUNTING FOOT

rubber suspension units which is bolted to the engine. A suspension pin passes through the bracket and housing assembly.

The drive end mounting feet which are secured on each side of the bi-directional gearbox, locate the position of the engine in its installation. The outside rear bolt holes of each foot and the holes in the engine bearer struts are reamed holes, the holes in the engine bearer positions being reamed on initial installation. The bolts which fit these positions are of a greater diameter than the remaining bolts.

The free end mounting feet which are secured on each side of the auxiliary drive gearbox are constructed to allow for axial thermal-expansion of the engine. It will be seen from the illustration opposite that the suspension pin of the drive end foot has a head (at the left hand side of drawing) and that when the nut at the opposite end is tightened, all components in association with the pin are tightened together. When examining the free end mounting foot, it will be seen that the left hand end of the pin is supported in a bush in which it is free to move axially and that the suspension units and housing can thus also move axially while the bottom bracket remains bolted to position on the engines bearer points of the installation.