BRITISH RAILWAYS

WORKSHOP OVERHAUL SCHEDULE

DIESEL MULTIPLE UNITS

ENGINES: 150 H.P. A.E.C. A.220 SERIES

150 H.P. LEYLAND R.E. 680/1 & R.E. 680/13

200 H.P. LEYLAND/ALBION R.E. 900 SERIES

ENDMENT NO. 83 DMU 200 H.P ENGINES
JANUARY 1970.

WORKSHOP OVERHAUL SCHEDULE

200 H.P LEYLAND ALBION ENGINE
Type 901 - H9
Type 902 - (ex 901 - H9)
Type 902/11
Type 903 (ex 901 - H9)
Type 903 - (ex 902/11)
FLUID COUPLING
FREEWHEEL UNIT

This Workshop Overhaul Schedule replaces forthwith any previously issued.

The only classification of repair is GENERAL.

General repairs are those which are normally carried out on a regular basis after the engine has been in service for a pre-determined number of miles.

The periodicity of classified repair is 180,000 miles for all but Western Region engines; for these the periodicity is 220,000 miles.

Freewheel units are shopped and overhauled at the same time as the associated engines and fluid coupling.

The work to be done on fluid couplings is included in the engine sections of this schedule. The work to be done on freewheel units is similarly included.

The shopping periods between classified repairs may be extended from time to time as equipment is more fully developed and becomes more reliable.

Inspection under the Red Label procedure is used to ascertain reasons for failure before scheduled life is attained, where these are obscure. (Refer to Standing Order No. T&RS/W/G5)

MENT NO. 29 D.M.U. 200 H.P. ENGINES
JANUARY 1969

200 H.P. LEYLAND ALBION ENGINES - R.E. 900 SERIES

WORKSHOP OVERHAUL SCHEDULE

These Workshop Overhaul Schedules for the above-mentioned engines replace forthwith any previously issued.

The engine is divided into components for the purpose of this schedule.

The only Classification of Repair is GENERAL.

General repairs are those which are normally carried out on a regular basis after the engine has been in service for a pre-determined number of miles.

The periodicity of Workshop Repair will vary from one Region to another depending on the condition under which the units are used.

The shopping periods between scheduled repairs may be extended from time to time as equipment is more fully developed and becomes more reliable.

Inspection under the "Red Label" procedure is used to ascertain reason for failure before scheduled life is attained, where this is obscure. (Refer to standing order No. T. & R.S./W/G/5).

This series of engines consists of:-

Type 901 - H.9
Type 902 - (Ex 901 - H.9)
Type 902/11
Type 903 (Ex 901 - H.9)
Type 903 (Ex 902/11)

AMENDMENT NO. 168. NOVEMBER 1974

200 H.P. LEYLAND ALBION ENGINES

INDEX TO GENERAL REPAIR SECTION

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
NE	Stripping and Cleaning. Rough clean. Remove all electrical components before cleaning in degreasing plant. Proceed to strip engine of sub-components :- Air Compressor Water Pump Fuel Pump and Injectors. Oil Pumps - Main and Scavenge Cylinder Heads Filters Right Angle Drive Rocker Gear Fluid Coupling (or Torque Converter where fitted) Heat Exchangers Fuel Pump Drive Unit Sub-components receive additional cleaning following further stripping.	Keep in engine sets until inspection completed.

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
DER HEADS	Thoroughly clean and descale internally using inhibited hydrochloric acid to B.R. Cat. No. 7/660; test for fractures and repair or renew as necessary.	See Data Section Item 1. See Appendix 'A'
	Check combustion face for distortion, erosion and fretting. Surface grind as necessary.	See Data Section Item 2. Amount of metal removed to be stamped on face.
Casting	Cover plates. where fitted, to be removed. Examine jacking nuts and retaining plate, and renew as necessary.	
Brass Blanking Plugs	Remove and rejoint.	
Studs $\frac{3}{8}$in U.N.F.	Remove and rejoint.	
s	Examine, regrind or renew as necessary.	See Data Section Item 3.
Seats	Examine and machine as required.	See Data Section Item 4.
Seat Inserts	Examine and check security. If renewal is necessary proceed as in Appendix F. Valve seating to be checked and recut and lapped as required.	See Data Section Item 5.
s	Examine for condition and bore size, check security within cylinder head casting. Recondition or renew as necessary.	See Data Section Item 6. Reconditioning consists of building up of exterior of guide to ensure security in head.
gs	Examine and check for correct compression, renew as necessary. Examine plates and collets, replace or renew as necessary.	See Data Section Item 7.
tor Tubes	Renew tubes as necessary. Renew washers.	Special attention must be given to sealing of tubes at upper and lower ends.

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
CYLINDER HEADS (Continued)		
Injector Holes	Examine for fractures, repair by 'Metalock' where possible.	See Data Section Item 8.
Transfer Holes (Water)	Examine for erosion and rebush as necessary.	
Valves, Springs etc. Assembly Check	Reassemble and check valve protrusion.	See Data Section Item 9.

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
TON ASSEMBLIES		
on	Examine visually and if in doubt, crack detect crown and gudgeon pin hole bore by dyepenetrant method.	
	Size all ring grooves axially.	See Data Section Item 10.
	Renew pistons as necessary.	
	Examine gudgeon pins and in cases of doubt, crack detect magnetically, check clearance in small end bush; renew as necessary.	See Data Section Item 10.
	Examine gudgeon pin retaining rings, renew as necessary.	
	Repair or renew all piston rings, ensuring correct gaps.	See Data Section Item 11.
ecting Rods	Examine connecting rod little end eye. If new bush is required, size internal diameter of hole. Interference fit to be 0.002 in.	See Data Section Item 12.
	Renew big end bearings, ensuring correct fit. When crankshaft big end bearing is ground, fit appropriate bearings.	See Data Section Item 13.
	Big end bolts to be renewed and on assembly to be torque. loaded and elongation checked.	See Data Section Item 14.

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
CYLINDER BLOCK	Thoroughly clean and descale internally.	See Appendix 'A' Particular attention to be paid to oil gallery, also 'tell tale' holes (where wet liners are fitted).
	Check for internal erosion and fretting.	Particularly in the area of the bottom liner sealing rings where wet liners are fitted.
	Test for fractures and repair as necessary.	See Data Section Item 15. Water test takes place with heat exchanges fitted.
	Check block bores for wear and machine as necessary.	See Data Section Item 16.
	Check top face for distortion, erosion and fretting. Surface grind as necessary.	See Data Section Item 17. The amount of metal removed to be stamped on cylinder block between heads.
Water Transfer Holes	Examine for erosion and rebush as necessary.	
Liners	Fit new semi-finished liners. After fitting, check visually for fractures and use dyepenetrant in cases of doubt. Hone bore to finished size.	See Data Section Item 18. See Data Section Item 18.
	Check for protrusion.	See Data Section Item 19.
Studs (High Tensile Steel)	Examine thread condition and check security, renew as necessary. Apply aluminium paint to studs to prevent corrosion.	See Data Section Item 20.
Camshaft Bushes	Check condition and size, renew as necessary.	See Data Section Item 21.
Main Bearing Housing and Caps	Check for alignment, rectify as necessary.	See Data Section Item 22.
No.1 Bearing Cap	Check condition of idler gear assembly.	

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
SHAFT	Visually examine.	
	Check for alignment.	
	Straighten if necessary, where straightening process is involved magnetically crack detect after straightening.	See Data Section Item 23.
	Check cam lobes for wear and correct lift.	See Data Section Item 24.
	Size journals and check condition of surfaces.	See Data Section Item 25.
	Polish journals and cams as necessary.	
	Clean out oil galleries and replace camshaft gear stud.	
	Check security and condition of lubricating oil pump gears, repair or renew as necessary.	
	Check key and keyway of camshaft drive gear.	
	Camshaft to be checked for end float when assembled in engine.	See Data Section Item 26.
Followers	Examine, surface grind, check hardness and crack detect magnetically, or renew as necessary.	See Data Section Item 27.
r Coupling	Examine for condition, renew as necessary.	
ust Washer	Examine for condition, renew as necessary.	

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
CRANKSHAFT	Clean out oilways. Check for flaws magnetically, including flywheel flange bolt holes. Check damper cone for fretting internally, scoring and damage externally, check condition of keyways, renew as necessary. Damper cone to be lapped to taper. Check for alignment at centre journal. Size crankpin and main journals and check condition of surfaces, recondition as necessary. Check for fretting beneath damper cone, dress as necessary. Check flywheel flange face for runout, correct by grinding. Renew flywheel bolts.	If flaw found scrap crankshaft, no attempt to be made to grind out. Scrap if damage is more than 1/16th deep. See Data Section Item 28. See Data Section Item 29. See Data Section Item 30. Ensure driving fit in crankshaft and flywheel flanges, using oversize bolts where necessary. See Data Section Item 31.
	Recondition or renew sludge pins as necessary.	
Flywheel	Examine bolt holes for condition. Ensure that holes and dowels in periphery of flywheel are in good condition. Repair as necessary.	See Engineering Instruction MD/76.
Starter Ring	Examine starter ring teeth and securing bolt holes, recondition or renew as necessary.	

GENERAL

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
MAIN BEARINGS	Renew all bearings. Fit oversize bearings for crankshaft if necessary.	See Data Section Item 32.
Centre Bearing	Examine bearing thrust flanges/thrust washers for condition. Renew as necessary.	See Data Section Item 33.

COMPONENT	WORK TO BE CARRIED OUT	REMARKS.
R GEAR		
and Pads	Examine visually, check arms for alignment, if correct, regrind pads, or renew whole as necessary.	See Data Section Item 34.
pression Lever and Shaft	Examine, renew as necessary.	
t Adjustment s and Locking Nuts	Check for condition and renew as necessary.	
r Shafts	Check alignment and condition. Renew as necessary. Examine retaining rings, springs and washers, renew as necessary.	See Data Section Item 36.
tal Brackets	Examine brackets and oilways, check dowels, and repair or renew as necessary.	

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
PS	Examine for fractures, using dyepenetrant method in suspect cases, repair or renew as necessary. Check joint faces for correct alignment. Examine sump right angle drive mounting ribs, ensuring they are at identical height. Examine bearing bush housings for security and condition (for water pump/right angle drive shaft and also the fuel injection pump drive shaft.)	

OMPONENT	WORK TO BE CARRIED OUT	REMARKS
OCTION PUMP, GOVERNOR		
PUMP	Strip, clean and examine:-	
sing	Check for flaws, examine base plate and hole threads for condition, repair or renew as necessary. Check base for fretting and mounting bolt holes for elongation. Repair as necessary.	
Valves ents	Renew as necessary.	
ssembly	Check rollers for lift.	Shims to be used to obtain correct plunger head clearance. Timing to be checked. - See Data Section Item 38.
	Rollers, pin and tappet body to be renewed as necessary.	
earings	Check track and rollers for pitting and heat discolouration. Renew as necessary.	
	Check for alignment, pitting and scoring of cams and oil seal wear on camshaft; crack detect. Repair or renew as necessary.	See Data Section Item 39.
	End float to be shimmed as necessary.	See Data Section Item 40.
	Coupling to be lapped to taper on camshaft.	See Data Section Item 41.
s	Check for wear on teeth. Renew as necessary.	On N and NN type pumps discard sintered quadrant and use brass type (BR Cat No 75/5521)
Rod and Bushes	Check teeth and bush bores for wear. Renew as necessary.	See Data Section Item 42. Ensure control rod is free within bushes and aligned to jig A.E.C. Part No. 7244/2.
Valve Holders	Check for wear within pipe cone connections.	To be renewed if any indication of wear. See Data Section Item 43.

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
L INJECTION PUMP, GOVERNOR FEED PUMP (Continued)		
ings and Spring Plates	Examine for corrosion and distortion, renew as necessary.	
Seals and Filter Pads	Renew.	
vernor	Check pins and yoke ends in link gear for wear, renew as necessary. Examine bushes and pins in governor weights for wear and renew as necessary.	Governor yoke to be reshimmed as necessary. See Data Section Item 45.
ed Pump	Renew diaphragm. Examine valves, seats, discs and operating lever pin and renew as necessary.	
el Pump Mounting Bracket	Examine, repair or renew as necessary.	
	Following reassembly, fuel injection pump, governor and feed pump to be tested.	See Data Section Items 37, 44 and 46. All apertures to be covered with protection caps or masking tape pending utilisation.

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
ECTORS	Strip, clean and examine:-	
der	Recondition or renew as necessary.	
et Adaptor	Examine cone and thread. Renew as necessary.	
zle Assembly	Examine the nozzle under a magnification of 10X and scrap any which show cracks in the vicinity of the injector holes or are suspect.	
	Check for wear on needle and nozzle seats, recondition or renew as necessary. Check fit of needle in nozzle body and needle lift. Recondition pressure face or renew nozzle assembly.	See Data Section Item 47. Special attention to be given to nozzle pressure face.
rings and Spindles	Renew as necessary.	
	Following injector reassembly, holder and nozzle assembly to be tested.	See Data Section Item 48. See Test Section Appendix A.

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
COUPLING		
and Mounting Plate.	**Check casing** and mounting plate for damage and fractures and drive bolt holes for elongation. Repair or renew as necessary.	
	Examine centre spigot and it's locating bore for condition and fit.	See Appendix H.
	Check oil filling tubes and pluge for condition of thread in the impellor casing. On parting casing check condition of dowels, bolt holes and bolts, also alignment of driving face to joint face.	
Assembly and Shaft	**Check condition of bearings and security in housing. Check spline for wear. Repair or renew as necessary. Renew gland assembly.**	**See Data Section Item 49. On Vulcan-Sinclair type, check runout of Runner Shaft internally prior to fitting output shaft.**
Coupling	**Check flange face for runout and condition of bolt holes for elongation.**	**See Data Section Item 50. Special attention to be given to security of internal nuts and bolts and also external periphery. 'Simmonds' type nuts to be renewed at each overhaul.**
	Assemble the fluid coupling to crankshaft, as follows:-	See Data Section Items 51 and 73.
	1. Thoroughly clean mating faces of crankshaft flange and flywheel; apply engineer's blue and ensure a contact area of greater than 80% is achieved. Machine offending face as necessary to obtain required contact area.	**On those engines fitted with the B.U.T. 20 in. diam. coupling with fins on the casing and 8 bolt fixing, the coupling has to be split before it can be removed from the crankshaft.**

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COMPONENT	WORK TO BE CARRIED OUT	REMARKS

2. Examine the flywheel surface around the eight bolt holes where flywheel nuts have previously bedded. This surface must be smooth and even and square to the flywheel axis. Machine as necessary to provide the required surface condition.

   NOTE: After machining as necessary, as called for in 1. and 2. above, the flywheel thickness in the vicinity of the flywheel bolt holes must not fall below 0.565". The flywheel should be scrapped if, in the provision of the surfaces required, the flywheel thickness falls below the dimension quoted.

3. Re-introduce 0.03" x 45° chamfer at both ends of 8 flywheel bolt holes in flywheel, as necessary, if removed by machining as called for in 1. or 2 above.

4. Fit dowel into flywheel.

5. In order to ensure correct fitting of the bolt head onto the crankshaft flange it is necessary to check:-

   (a) that the flange face onto which the bolt head bears is flat and square to the crankshaft axis.

   (b) that a 0.03" x 45° chamfer is present between the above mentioned flange face and the bolt holes.

   If these conditions are not met it will be necessary to correct by grinding.

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COMPONENT	WORK TO BE CARRIED OUT	REMARKS

6. Rear oil thrower (B.R. Cat. No. 15/84599) must not be fitted.

7. Clean flywheel bolts and nuts using clean cloth or paper towel.
Details of the flywheel bolts and nuts are as follows:-

Bolt : BR. Dgr. C-A3-10021 Item 1, BR. Cat. No. 15/1088

Nut : " " " " 2, " " " 15/1089

8. Offer flywheel up to engine crankshaft and fit bolts ensuring that this is done without undue force which may damage bolt.

9. Fit disc spring washer B.R. Cat. No. 3/85750 to each bolt such that convex face comes adjacent to the flywheel nut (fig. 1). Lubricate bolt threads with oil, fit nuts and pull up initially by hand.

10. Set torque spanner to 200 lbf/ft and tighten bolts in accordance with the sequence shown in fig. 2 in several stages to the required torque loading.

11. Check flywheel for eccentricity. This must not exceed 0.004".

NOTE: Flywheel bolts and nuts must not be re-used. As engines are stripped in Works, the flywheel bolts and nuts must be deliberately damaged to prevent re-use.

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
nge Coupling (Cont'd)		
1 Series Engine Only	1. Thoroghly clean mating faces of crankshaft flange and flywheel. Apply Engineer's blue and ensure a contact area in excess of 80% is present. If not, machine offending face as necessary.	
	2. Degrease both mating surfaces and ensure they are clean and dry.	
	3. Fit dowel to flywheel.	
	4. Discard paper joint, B.R. Cat. No. 15/84604.	
	5. Apply thin even film of Loctite Plastic Gasket, B.R. Cat. No. 7/60440 to one face only, such that the whole contact area is covered.	Note To ensure that the plastic gasket has fully hardened, 24 hours must elapse between fitting the flywheel and running the engine
	6. Offer flywheel up to crankshaft and fit flywheel bolts ensuring that this is done without undue force which may damage bolt.	
	7. Fit disc spring washer B.R. Cat. No. 3/85750 to each bolt such that convex face comes adjacent to the flywheel nut (Fig. 1). Lubricate bolt threads with oil, fit nuts and pull up initially by hand.	
	8. Set torque spanner to 200 lbf/ft and tighten bolts in accordance with the sequence shown in fig. 2 in several stages to the required torque loading.	
	9. Check flywheel for eccentricity. This must not exceed 0.004".	
	10. Check periphery runout and test.	

Flange Coupling - Figures 1 & 2

FIG. 1

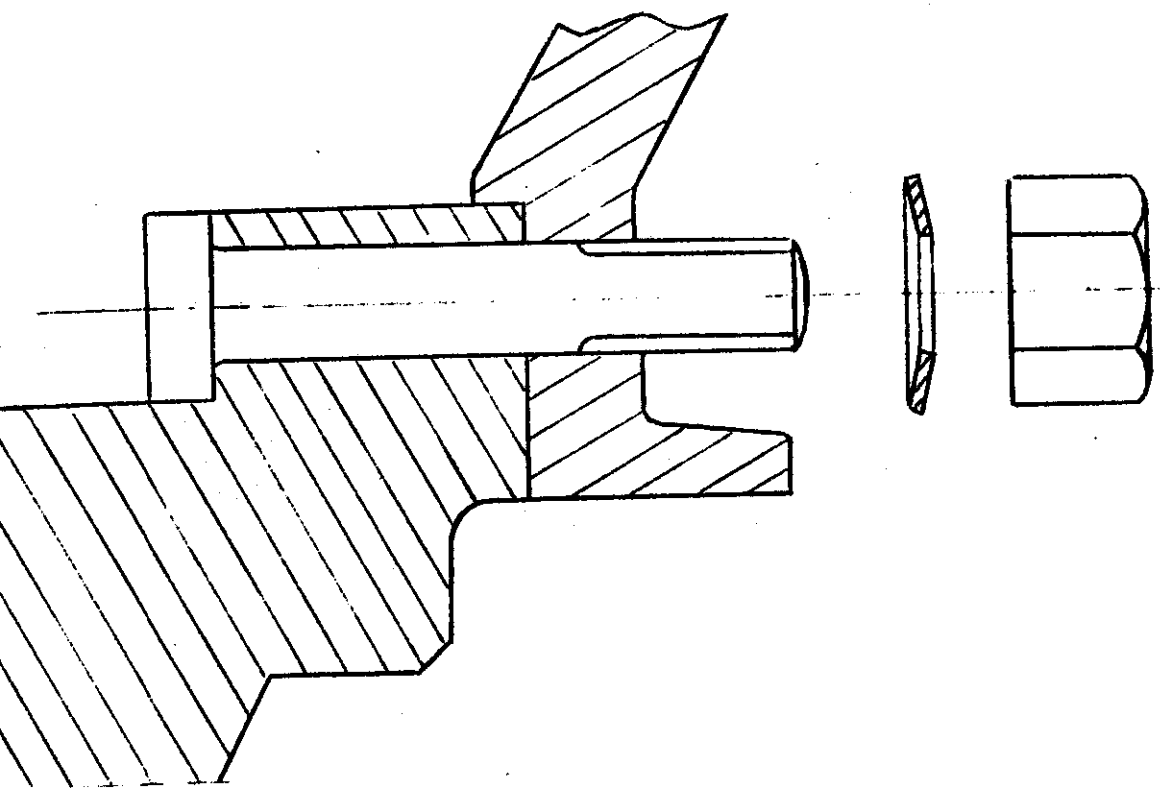
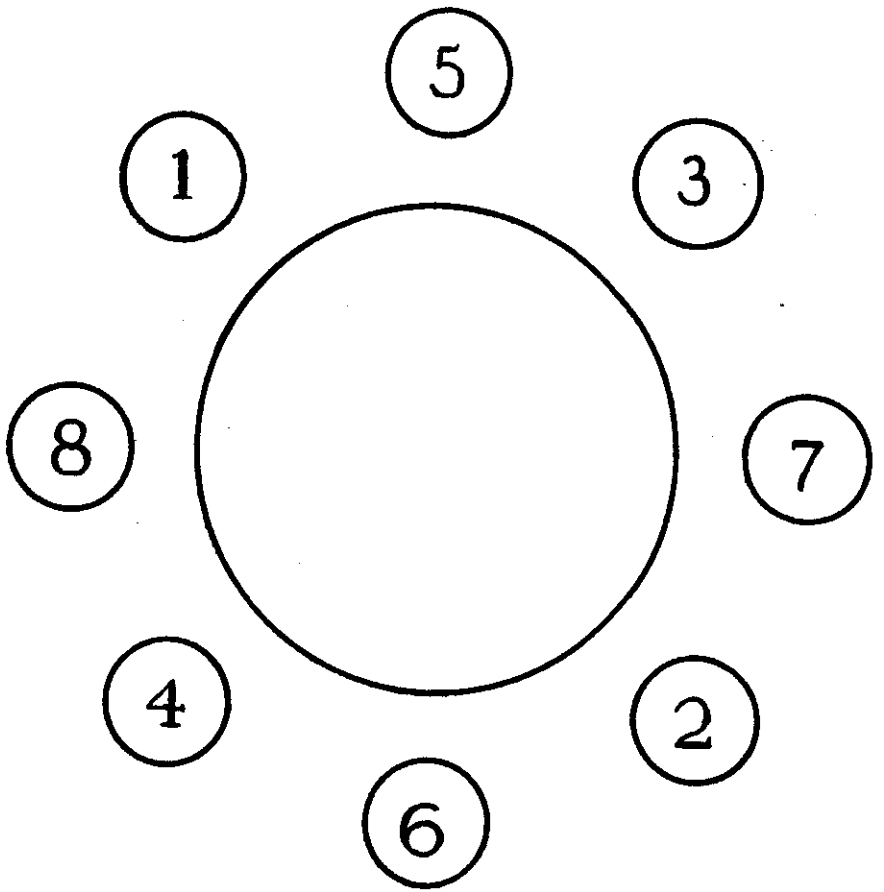


FIG. 2

FLYWHEEL BOLT TIGHTENING SEQUENCE



GENERAL

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
HANICAL INTERNAL COMPONENTS.		
Pumps and Drive - Main Scavenge	Strip, clean and examine. Examine body for scoring and renew as necessary. Examine thrust faces for scoring and lap as necessary. Examine driven gear spindle and bearings for scoring, renew as necessary. Check gear teeth for bruising and dress or renew as necessary. Check driving gear spindle and bearings for wear or scoring on journal and also on driving dog, renew as necessary. Check thrust faces on end covers for scoring and lap if not excessive. Assemble and ensure pump functions correctly.	See Data Section Item 53. See Data Section Item 54. See Data Section Item 52.
h Rods	Examine ball and socket ends, check alignment, renew as necessary.	See Data Section Item 55.
ing Back Plate	Examine and check for alignment, straighten or renew as necessary.	
ector Clamps	Examine for bow, straighten or renew as necessary.	See Data Section Item 48.
Strainer and Pipes	Examine mesh, renew as necessary. Remove pick-up pipe and clean internally.	
Relief Valve	Strip, clean, examine and renew items as necessary. Give functional test to ensure correct seating of valve before fitting.	Pressure setting to limits laid down in Engine Test Section
ing Wheels	Examine gear teeth, bushes and thrust washers visually, crack detect spindles magnetically. Renew as necessary.	See Data Section Item 56.

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
ECHANICAL EXTERNAL OMPONENTS.		
xhaust Manifolds	Clean, examine, repair or renew as necessary, ensuring correct alignment of flanges with main pipe. Renew centre rings.	Front and rear manifold pipes to be machined together. Stored and fitted in sets. On assembly, threaded parts to be coated with molybdenum disulphide.
ater Rail	Examine, repair or renew as necessary.	
iming Case	Examine for fractures and repair or renew as necessary. Renew oil seals and Metalastik bush.	
rankshaft End Cover	Examine for fractures, repair or renew as necessary. Renew oil seal.	
ack Mounting Plate	Examine, check for alignment and straighten or renew as necessary. Renew Metalastik bushes.	
ipework (Lubricating Oil)	Pipes to be cleaned externally and internally examined and renewed as necessary. All nuts and cones to be examined and renewed as necessary. Test pipes after re-setting or re-brazing.	Fit protection caps after testing. See Data Section Item 58.
il Filler Assembly	Main casting, studs, springs, pins, dip stick and cap to be cleaned and examined. Repair or renew as necessary. Renew joints.	
Rocker Covers and Set Screws	Clean and examine for fractures, repair or renew as necessary. Examine screws for alignment and condition of thread.	
Breathers	Examine and repair or renew as necessary.	

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
MECHANICAL EXTERNAL COMPONENTS (Continued)		
Damper	Check condition of damper.	See Appendix B. See Data Section Item 59.
Oil Filters (Full Flow) and Relief Valve	Strip, clean and examine, repair or renew items as necessary. Renew paper elements. Relief valve to have functional test.	
Centrifugal Filter and Cut Off Valve	Strip, clean and examine, repair or renew as necessary.	Ensure 'O' ring BR Cat No 15/1101 is used as seal of the cover of GF2 contrifugal filter
Fuel Pump Drive	Examine shaft, gear wheel and shaft bearings. Renew as necessary	
Coupling Flange	Ensure correct fit to shaft. Examine condition of bolt holes, ensure correct fit to shaft, repair or renew as necessary. Renew oil seals.	
Coupling (Fuel Pump and Drive Shaft)	Examine coupling discs, and bolt holes, and renew as necessary.	
Water Pump Drive	Examine shaft, gear wheel, and shaft bearings, renew as necessary.	Special attention to be given to keys and keyways.
Driving Flange	Examine for condition of belt holes, and fit on driving shaft. Renew oil seals.	

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
CILLARY COMPONENTS		
el Pipes and Connections	Examine for chafing, cone wear and thread condition.	All pipes to be fitted with protection caps pending utilisation.
High Pressure Pipes	Renew as necessary.	
Fuel Supply and Return Pipes	When fuel leak-off pipes require repair or replacement make up and fit copper leak-off pipes as necessary.	
ravity Vent Valve	Examine for condition, ensuring drillings are clear and that brass valve is free to move. Renew items as necessary.	

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COMPONENT	WORK TO BE CARRIED OUT	REMARKS
n-Return Valve	Examine for condition, brass disc and both seats. Renew items as necessary.	Care to be taken to ensure that 'T' connection is nearest to return pipe to fuel tank.
el Filters (Triple Bowl)	Strip and clean, renew paper filter elements and seals. Renew inlet and outlet unions, as necessary.	
ses	Renew using Nitrile Hoses to B.R. Spec. 488 A.	Fit in accordance with Eng. Instruction MD.6.
ter Pump	Strip, clean and examine, repair or renew items as necessary.	
	Renew carbon and oil seals.	
ight Angle Drive Unit	Strip, clean and examine, repair or renew items as necessary. Renew oil seals. On assembly, check bevel gears for back lash and Renew Layrub couplings.	See Data Section Item 60.
hermostats, Wax Element Type (where fitted)	Remove and re-fit new or re-conditioned element. Displaced elements to be check for condition and tested for correct operating temperature.	

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
ANCILLARY COMPONENTS (Continued)		
THROTTLE MOTOR	Dismantle and clean.	
	Examine housing end plate, bushes and renew as necessary.	See Data section item 66A.
	Examine shaft and renew if badly worn.	
	Examine sleeves for wear or fractures, and renew as necessary.	
	Examine hammers for wear and renew as necessary.	
	Examine plungers for scoring and fit new seals.	Polish out scoring if not excessive.
	Examine cylinder sleeves for wear, if stepping is visible resleeve and rebore. Fit new joints to cylinder caps.	
	Renew grease nipples as necessary.	
	Renew ball joint on external lever.	
	Renew studs in body as necessary.	Use Helicoil inserts to repair body threads.
	Carrier bracket, examine for fractures, repair as necessary.	
	Internal stops, examine for dimpling on heads and damage to threads. Renew as necessary.	Use Helicoil inserts to repair body threads.
	Re-assemble, using new joints. Ensure shaft end float is correct.	See Data section item 66B.
	Refit motor to the engine.	

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
ANCILLARY COMPONENTS (Continued)		
Air Compressor (Complete with Mounting Bracket)	Strip, clean and examine :-	
Cylinder Block	Rebore or reliner as necessary. Ensure that cylinder bores are free from glase.	See Data Section Item 61.
Bearings	Renew as necessary.	
Valves	Renew discs and inlet and delivery springs.	
Valve Seats	Examine for condition, recondition as necessary	See Data Section Item 62.
Connecting Rods	Big ends to be reconditioned as necessary.	See Data Section Item 63.
Piston and Rings	Examine pistons for condition, renew as necessary.	Rings are checked for gap in the cylinder to which they are to be fitted - See Data Section Item 64.
Crankshaft	Check for alignment, recondition or renew as necessary. Ensure that oilways are clear.	See Data Section Item 65.
Lubricator Strap	Examine for condition, renew as necessary.	
Heat Exchangers	Outer casings to be removed, oil inlet and outlet connections to be examined. Pressure test tube stacks, repair or renew as necessary. Renew joints.	See Data Section Item 15 and 66.
Rear Mounting Plate	Crack detect and repair by welding as necessary. Anneal and straighten after welding.	

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
RICAL EQUIPMENT		
g Harness	Clean, examine cables and conduit and renew as necessary.	To be tested after harness refitted to engine. Ensure correct assembly of Niphan socket. See Data Section Item 67.
ure Switches	Renew and adjust to appropriate pressure.	See Data Section Item 68.
Generator	Strip, clean and examine, megger test generator. Renew bearings and shaft as necessary. Renew rubber oil seals. Remagnetise rotor as necessary. Test and calibrate on reassembly.	See Data Section Item 69.
Solenoid and Linkage	Strip, clean and examine, renew items as necessary. Test on assembly.	See Data Section Item 70.
er Motor	Overhaul in accordance with recommended process Specification No. C.E.P.S.14.	

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
EEWHEEL (A.E.C. Type)	Strip, clean, and inspect components for wear, cracks pitting. Components not detailed below should be renewed on condition.	
CAM	Light markings on the faces may be removed by careful hand stoning. Indentations deeper than .002" may be removed by grinding parallel to the existing flats, removing the minimum necessary amount of material. The departure from nominal across-flats size should be etched or painted on the surface of one of the cam slots; e.g. "-3" would indicate an across-flats size of 3.987 in.	See Data Section Item 74.
	Components below the minimum dimension must be discarded.	
OUTER RACE	Indentations should be removed by regrinding, removing the minimum necessary amount of material. When the maximum permissible size is reached, the outer race should be reclaimed by hard chromium plating. The surface must be ground to remove indentations before despatch for plating, and ground again after plating to remove any surface imperfections. The departure from nominal size should be etched or painted on the outer surface; e.g. "+6" would inicate a diameter of 5.006".	See Data Section Item 75
	Should it be found that a deposit thickness of 0.020 in. does not produce a range of reclaimed outer races suitable to enable the complete stock of serviceable cams to be used, a smaller deposit thickness is acceptable for appropriate batches of components. A greater thickness of deposit is not acceptable.	
	Components with a bore size greater than 5.040in. after grinding must be discarded.	

/Continued.....

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
OUTER RACE (Cont'd.)	Assembly of unit to obtain correct end float. Cams and outer races must be matched so that the difference between the bore size of the outer race and the across flats measurement of the cam lies in the range 1.013± 0.009in. Oversize rollers must not be used. A) Assemble the outer race with the output yoke temporarily bolted up tight with two set screws ensuring that retaining plate (K.13101) is in position. B) Press outer race of the output bearing fully home to bed on retaining plate. C) To the cam (K.13103) assemble the retaining washer (K.13102), spring (K.13104), spring retainer (K.13109) and distance washer (K.13110). D) At the output end of the cam fit two 0.031" shims (Z4/46506) and the inner race rollers of the output bearing. E) Fit a suitable shim (Z4/46504, Z4/46507) and the inner race and rollers of the input bearing to the input end of the cam. F) Assemble the cam assembly into the free wheel outer race assembly with the rollers (K.13108). G) With the outer race of the input bearing pressed into the input seal housing (K.13116) and the seal in place, fit this (with two temporary screws) to the free wheel outer race. H) Remove the yoke and washer and measure the end float of the cam assembly. J) Correct the end float, if necessary, by fitting the correct shim between the input bearing inner race and the retaining washer (K.13110). K) Apply jointing compound to the output yoke face where this beds to the free wheel outer race housing and the input seal housing flange to ensure grease tightness on assembly.	See Data Section Item 76 See Data Section Item 77

/Continued.....

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
OUTER RACE (Cont'd.)	L) Fit remainder of set screws and dowels to the input and output flanges. M) Fit locking wire. N) Lubricate with specified grease; see lubricant schedule.	
FREE WHEEL UNIVERSAL JOINT. 1600 SERIES.	Overhaul and assembly of these joints is to be in accordance with Repair Procedure No. D.M.U./Gen/4.	

GENERAL.

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
EWHEEL YLAND 12-ROLLER TYPE)	Strip, clean, and inspect components for wear, cracks & pitting. Components not detailed below should be renewed on condition.	
CAM	Light markings on the faces may be removed by careful hand stoning. Indentations deeper than .002" may be removed by grinding parallel to the existing flats, removing the minimum necessary amount of material. The final across-flats dimension should be noted.	See Data Section Item 79.
OUTER RACE	Indentations should be removed by grinding, removing the minimum necessary amount of material. When the maximum permissible size is reached, the outer race should be reclaimed by Hard Chromium Plating; the surface must be ground to remove indentations before despatch for plating, and ground again after plating to remove any surface imperfections. The final internal diameter should be noted.	See Data Section Item 80.
ROLLERS	Degrease; re-use if the surface is not seriously damaged.	See Data Section Item 81.
RE-ASSEMBLY	It is essential that cams and outer races be correctly matched. Lubricate assembly as specified in Lubricant Schedule.	See Data Section, Item 82.

APPENDIX 'A'.

DESCALING AND DE-RUSTING IRON OR STEEL CYLINDER BLOCKS AND HEADS.

EANING.

tails of the procedure for descaling and derusting iron or steel cylinder blocks and heads of D.M.U. engines stripped in Works are follows:-

General.

A.1. The waterways of cylinder blocks and heads are descaled separately after the engines have been cleaned and degreased externally, and then stripped down.

A.2. If waterside surfaces show oily contamination the parts should be degreased by immersion in an alkaline cleaning tank.

A.3. Any aluminium parts which may come into contact with the acid must be removed.

A.4. The cleaning processshould be carried out over a drained area treated to withstand strong acids.

A.5. Staff handling acid must wear suitable protective clothing, i.e. rubber boots, apron and gloves, and a vizor or goggles.

Cylinder Blocks.

B.1. Position the block (on the drained area) with the largest openings to the water-space uppermost. Blank off all other water holes with plugs or plates.

B.2. Fill the block with water to ensure freedom from leaks, then drain.

B.3. By means of a steam lance, flush out loose deposits and heat the block. Drain out condensed water.

B.4. Immediately fill the water-space of the block with diluted hydrochloric acid, prepared in a separate acid-resistant container, e.g. a plastics bucket, by mixing equal volumes of inhibited hydrochloric acid, Cat. No. 7/660, and water.

B.5. Leave the acid to react for about four hours.

B.6. Drain the acid to waste by removing the lowest plug in the block.

B.7. Rinse the interior of the block with running water.

B.8. Fill the block with soda ash solution (8 oz/gall)., leave five minutes, and drain.

B.9. Remove all plugs and plates from waterway openings and rinse the interior thoroughly with a steam/water lance.

B.10. Examine the block. If deposits remain, repeat the acid cleaning process from B.1.

B.11. Spray de-watering fluid ("Ardrox 36" or similar) on all machined surfaces to prevent rusting before completion of the overhaul.

APPENDIX 'A'.

EANING. (con'd)

Cylinder Heads.

C.1. Immerse the head, open side uppermost, in inhibited hydrochloric acid, Cat. 7/660, diluted with an equal volume of water, in a suitable acid-resistant container for about four hours. (The strength of the acid bath shoul be checked periodically and adjusted to 5N. When its action becomes too slow, the contents of the bath should be discarded and replaced by fresh diluted acid - consult the Area Scientist about these points of acid bath control).

C.2. Remove the head from the acid bath, and drain acid from the head into the bath.

C.3. Rinse the head with running water.

C.4. Neutralise residual acid in the head by immersion in a dilute alkaline solution - 5% (8 oz/gall) soda ash solution is suitable.

C.5. Thoroughly rinse the waterways in the head with a steam/water lance.

C.6. Dip the head in de-watering fluid.

Acid-resistant container.

If a plastics tank is used, it should be a good quality, stress free moulding, made from high density polyethylene. A polythene domestic cold water tank is not recommended for this service. The Area Scientist can advise on sources of supply of suitable tanks.

INSPECTION OF CRANKSHAFT DAMPERS.

1. General.

Viscous crankshaft torsional vibration dampers consist of an outer casing positively attached to the engine crankshaft and an inner heavy mass running on a phosphor bronze bearing separated from the outer casing by a high viscosity silicone fluid. The typical arrangement is shown in figure 1.

The clearance between the outer casing and inner mass is 0.010" - 0.015" and hence even the slightest knock will tend to damage the damper.

As the crankshaft rotates uniformly the outer casing and inner mass rotate at the same speed, but when the crankshaft motion is erratic due to torsional vibration, then the outer casing follows this motion whilst the inner mass, by virtue of its inertia, attempts to rotate uniformly. Thus the tortional vibrations are damped by the shearing of the high viscosity fluid, and the energy is dissipated in the form of heat.

2. Damper Removal.

Dampers should be removed from the engine using the correct extraction tool. Under no circumstances should dampers be forced off by levering against the casing. Care must be taken to ensure that the damper does not strike the engine or fall to the floor during or after removal.

3. Transportation in Workshops.

Dampers must not be thrown or rolled.

At all times dampers should be transported on trolleys firmly supported to avoid direct mechanical contact. As they are heavy (up to 30 lb. each) the carrying of dampers is not approved as there will be a tendency to drop the damper on arrival at the destination.

4. Inspection (used dampers).

Before the damper can be inspected it is necessary to remove the power take off (where fitted) and the hub, thus exposing the complete item. This also applies to twin dampers.

The following inspection procedure should be adopted :-

(i) Check date code (if the damper has been dated) and scrap if life expired. (See Section 8).

(ii) Remove all paint from the damper (chemically, by blasting, or wire brushing) - do not subject to heat above 80°C.

(iii) Visually examine the fixing holes for elongation. No wear is permitted.

(iv) Visually examine the damper for signs of external damage, especially on the edges where it may have been dropped or knocked. The damper must be rejected if deformities are visually detectable.

GENERAL REPAIR SECTION - APPENDIX 'B'

INSPECTION OF CRANKSHAFT DAMPERS (CONTINUED)

4. (Continued)

(v) Check the back face of the damper for flatness with a straight edge and 0.005 in. feeler gauge. If it is possible to enter the feeler gauge between the damper casing and straight edge the damper must be scrapped.

(vi) Check the periphery of the damper for flatness with a straight edge and 0.005 in. feeler gauge. If it is possible to enter the feeler gauge between the damper casing and straight edge the damper must be scrapped.

(vii) Measure and note the damper thickness at 8 equally spaced intervals on a 9 in. (approx) PCD. If the variation exceeds 0.006 in. the damper must be scrapped.

5. Reclamation.

There are no permitted reclamation procedures for crankshaft dampers. Those failing inspection should be scrapped immediately.

6. Storage.

Dampers must be stored vertically in such a way that they cannot roll or come into contact with each other. This applies to new dampers which have not been in service as well as used ones.

A suitable storage unit is shown in Fig. 2 although existing arrangements may be maintained provided that they meet the above requirements.

7. Reassembly.

Before reassembly check that the damper has not developed a leak during storage (which would not have been detected earlier due to the generally dirty condition of the engines). When fitting the hub, first check that the mating surface between the damper and hub has a bed of at least 80% (which should be checked by the correct use of engineer's blue). Tighten down the bolts evenly to 22 lbs.ft.

NOTE: The power take-off to BR.Cat.No. 15/84975 originally fitted to Leyland Albion engines should not be refitted on future builds.

When fitting a new damper, the date of fitting should be etched on to the damper, in the position shown in Fig. 3 giving the month and the year e.g. 9/73.

8. Service Life

The service life of dampers is approximately 8 years and dampers inspected at engine works overhaul which are within 12 months of being life expired should be scrapped.

GENERAL REPAIR SECTION - APPENDIX 'B'

INSPECTION OF CRANKSHAFT DAMPERS (Cont'd.)

9. New Dampers

Dampers received from the manufacturers which have not had the necessary holes drilled or the internal diameter bored should be machined in accordance with drawing C-A2-9552.

FIG. 1 TYPICAL TORSIONAL VIBRATION, VISCOUS CRANKSHAFT DAMPER

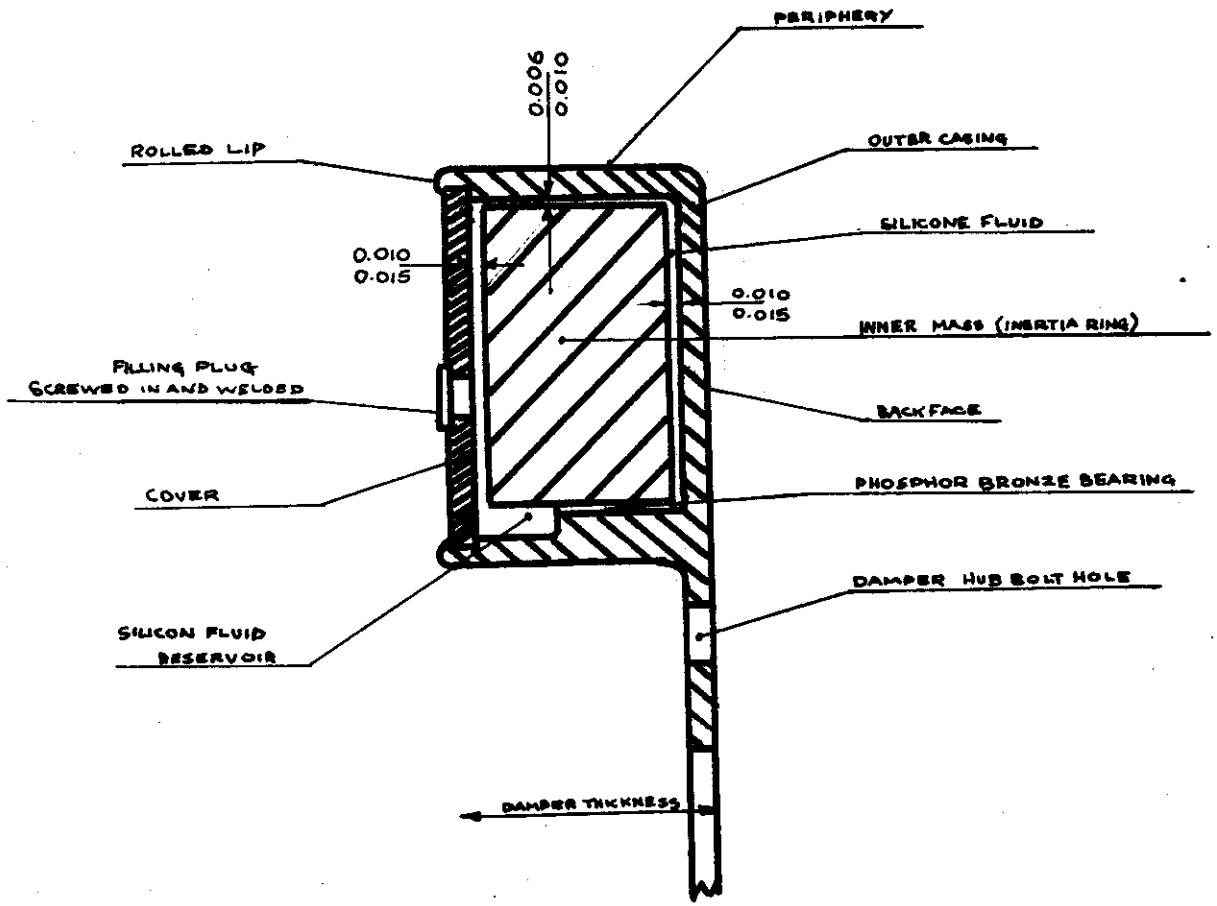
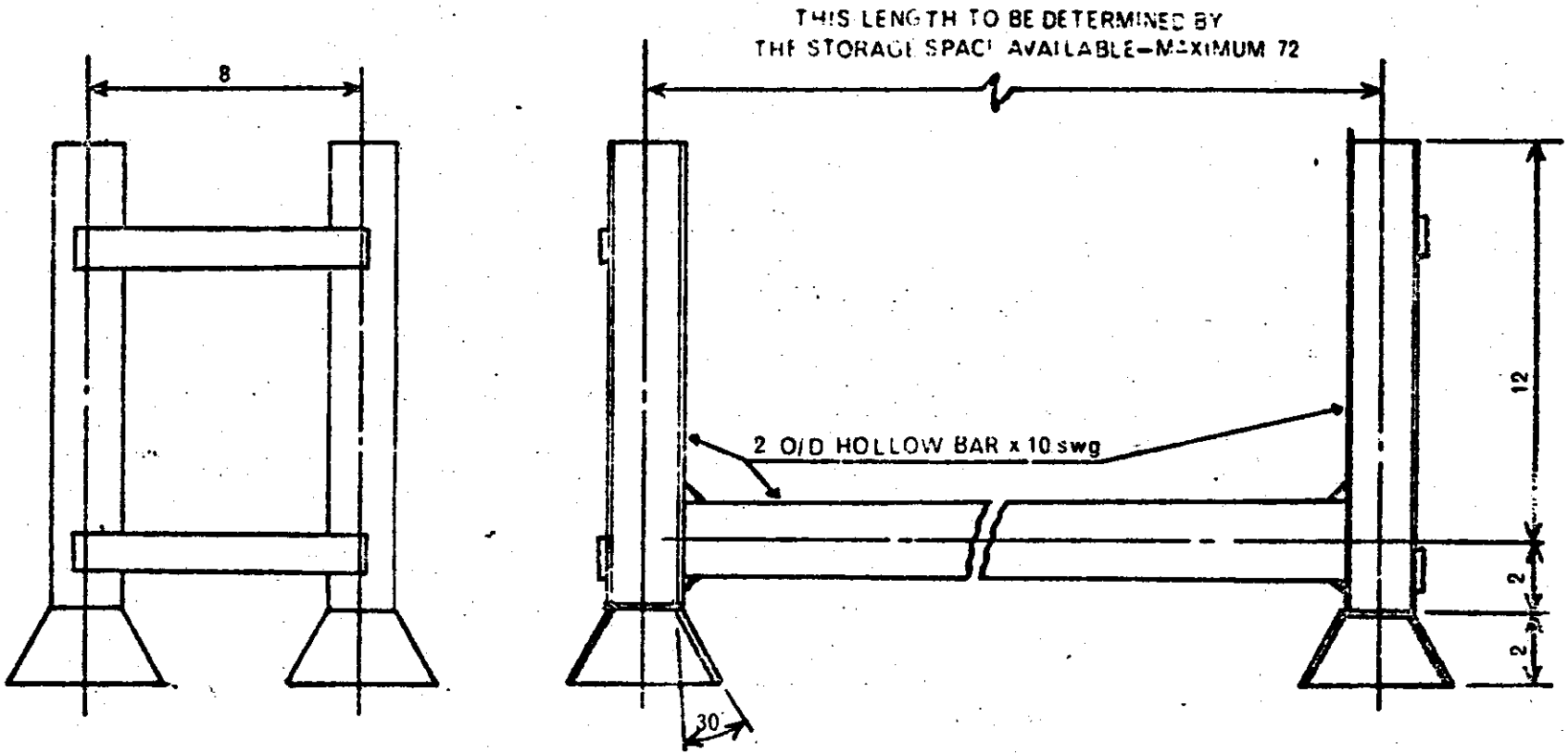
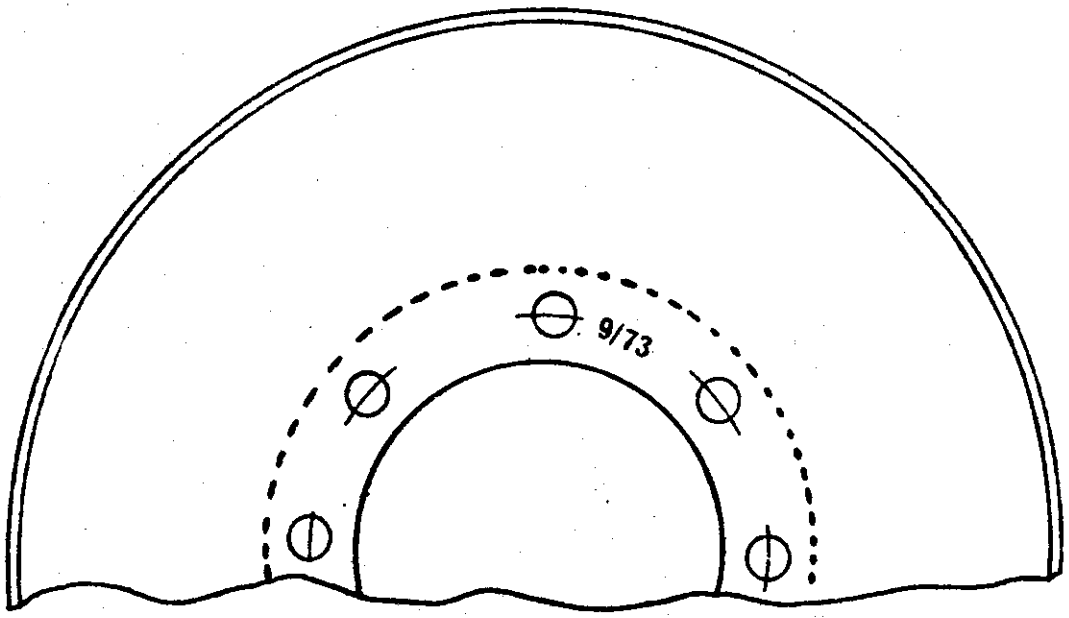


FIG. 2. DAMPER STORAGE UNIT.



all dimensions in inches.

FIG. 3 POSITION OF DATE CODE.



FITTING OF CYLINDER HEAD VALVE SEAT INSERTS

PROCEDURE

1. Remove existing inlet and exhaust valve seat inserts from clyinder head.

2. Surface grind bottom face of inserts as follows:
   - i (a) Inlet - Standard (2.704" O/D B.R. Cat. No. 15/84955) to achieve dimension 'X' (See fig. 1.).
   - (b) Inlet - Oversize (2.724" O/D B.R. Cat. No. 15/85290)
     (2.804" O/D B.R. Cat. No. 15/84539)
     (2.824" O/D B.R. Cat. No. 15/85288)
     to achieve dimension 'X' (See fig. 2.).
   - ii (a) Exhaust - Standard (2.454" O/D B.R. Cat. No. 15/84956) to achieve dimension "Y" (See fig. 2.).
   - (b) Exhaust - Oversize (2.473" O/D B.R. Cat. No. 15/85292) to achieve dimension "Y" (See fig. 2.).

3. Produce 0.3125" radius ± 0.005" on periphery of bottom face of inlet and exhaust valve seat inserts.

4. Place inserts in insulated box containing solid CO_2 and leave for 25-30 minutes.

5. Remove inserts from box and fit into machined bore in cylinder head with the aid of a suitably formed tool.

6. Ensure that inserts 'bottom' in bore.
   This can be checked by placing feeler gauges between bottom face of insert and the corresponding face on cylinder head. Maximum permissable gap at any point between these faces is 0.0015".

FITTING OF CYLINDER HEAD VALVE SEAT INSERTS (CONT'D.)

FIG. 1 (NOT TO SCALE)
CROSS SECTIONAL VIEW OF THE INLET VALVE SEAT INSERT AS FITTED TO THE CYLINDER HEAD

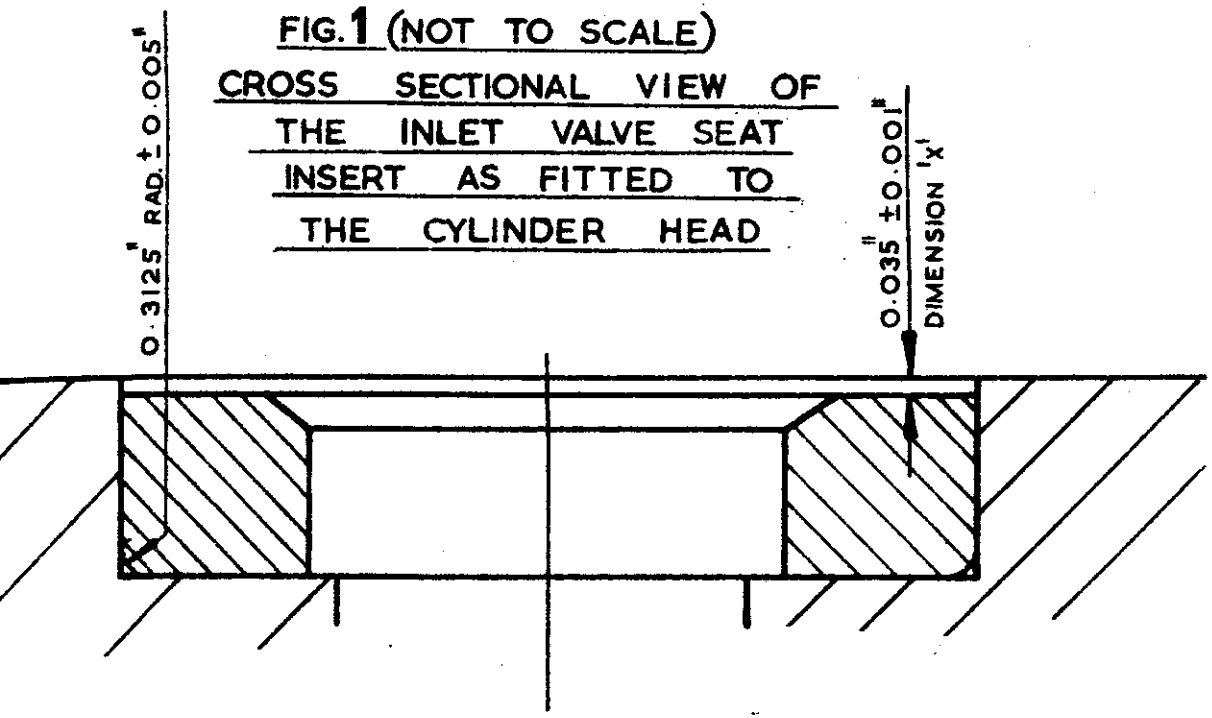
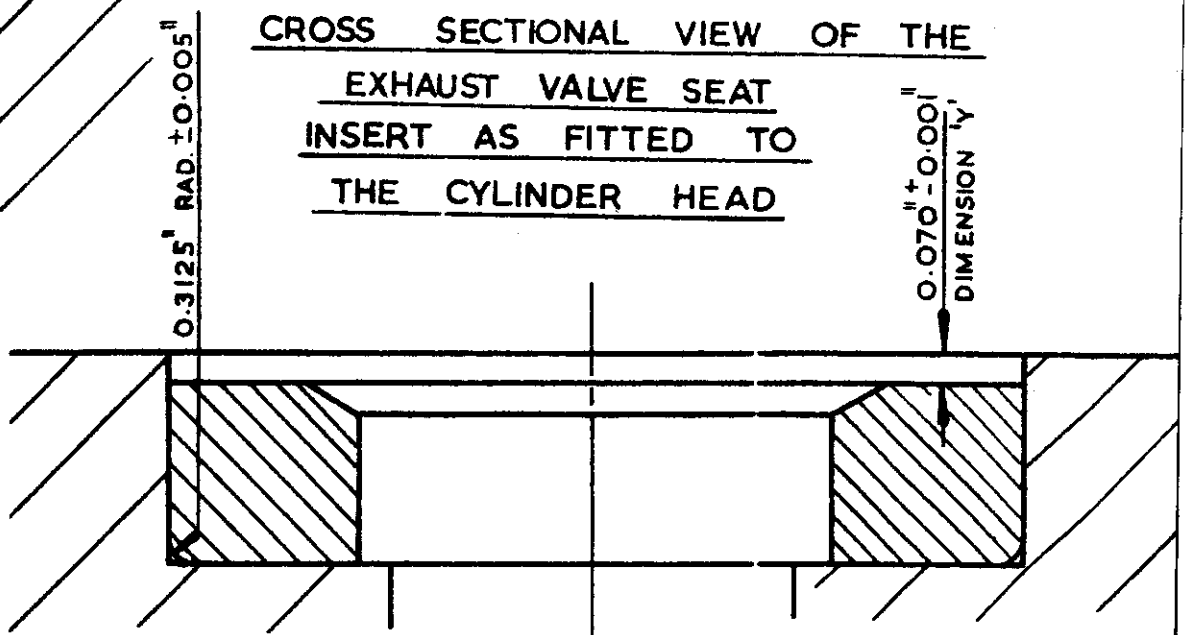


FIG. 2 (NOT TO SCALE)
CROSS SECTIONAL VIEW OF THE EXHAUST VALVE SEAT INSERT AS FITTED TO THE CYLINDER HEAD



HARTRIDGE 1100 FUEL PUMP TEST STAND

When calibrating N and NN fuel injection pumps (AEC, Leyland and Leyland - Albion) the CR400 coupling will be used.

The following items are required per test stand to incorporate the CR400 coupling:-

Qty	Description	Drg. No/Part No/Spec.	B.R. Cat. No.
1	ADAPTOR PLATE	B.R. Drg. No. C-AL-21155	39/43215
2	Hexagon Socket-Head Cap Screw 3/8" UNC x 1"	BS2470, Table 2A, Flat End	35/56954
3	Hexagon Socket-Head Cap Screw 5/16" UNF x 1¼"	BS2470, Table 2A, Flat End	35/56956
1	SPIDER	CAV PT No. 86562	39/61842
1	RUBBER INSERT	CAV PT No. 86565	39/36721
1	COUPLING (20 mm Taper for 'N' Pump)	CAV PT No. 61333	39/8384
1	COUPLING (25 mm Taper for 'NN' Pump)	CAV PT No. 86563	39/8385

FITTING OF ADAPTOR PLATE AND SPIDER

Position the two, 3/8" UNC x 1" Cap Screws in the adaptor plate. Locate the coupling spider onto the adaptor plate male spigot, rotate to align holes and fit and tighten the three 5/16" UNF x 1¼" Cap Screws. Offer the adaptor plate spider assembly onto the Hartridge 1100 nose-cone spigot, engage and tighten securely the two 3/8" UNC Cap Screws and fit the rubber insert into the spider.

NOTE: It may be necessary to remove by filing a small amount of metal from the coupling spider to allow Allen key access for tightening the two, 3/8" UNC Cap Screws.

FUEL PUMP PREPARATION

Fit required coupling to fuel pump camshaft i.e. 20mm Taper coupling for the 'N' pump, 25 mm Taper Coupling for the 'NN' pump. Position fuel pump on Test Stand, align 'fingers' of mating coupling halves and push the fuel pump bodily towards the nose-cone to achieve engagement. Ensure that the fuel pump is aligned axially on the Test Stand and that a minimum end clearance of 5mm is present between the "finger" ends and the rubber insert. Clamp the fuel pump in position and test and calibrate in the normal manner.

Renew the rubber insert if the end clearance becomes less than 5mm or if any rotational 'play' in the coupling is present.

Orders for the CAV components of the CR400 drive coupling should be placed on:

CAV Ltd.,
PO Box 36,
Warple Way,
LONDON. W37SS

When testing NL6F80/160, NNL6H100/438K, NL6F90/161, NL6F90 and NNL6F90/167 type pumps the following requirements must be met:-

(A) Ensure that the test-rig complies with the following conditions:

(i) Nozzle holders BKB50SD533b, Nozzles BDN12SD12
(ii) Injection setting pressure : 175 atm
(iii) High pressure pipes : 6mm x 2mm x 600mm long.
(iv) Feed pressure : DFP3/2 : 2 to 5 lbf/in^2 (0.14 to 0.35 kg/cm^2)
DFP3/10 : 15 to 18 lbf/in^2 (1.05 to 1.26 kg/cm^2)
(v) Calibration fluid temperature : 40 to 45°C.

(B) (i) Phase, calibrate, set governor, set and seal maximum fuel stop at prescribed fuelling in normal manner.
(ii) Run fuel pump at 100r/min with control lever in maximum position.
(iii) Adjust excess fuel stop to give the following delivery:

FUEL PUMP TYPE	ENGINE TYPE	FUEL DELIVERY PER 100 SHOTS AT 100r/min (cc)
NL6F80/160	Leyland 680/1/13	15 cc ± 1 cc
NNL6H100/438K	Leyland 680/1595	
NL6F90/161 or /60	AEC A220	
NNL6F90/167	Leyland Albion	18 cc ± 1 cc

(iv) Tighten locknut, replace cover and apply lead seal.

CORRECT LOCATION OF FLUID COUPLING TO ENGINE
LEYLAND ALBION 902/903 SERIES ENGINES

The correct fit of the fluid coupling centre spigot into its locating bore in the adaptor plate and its concentricity with the runner shaft bearing housings, are the prime factors in guaranteeing correct location of the fluid couplings to engine.

To ensure that the correct fit is achieved, the following procedure shall be applied.

1. Spigot Bore

Measure the internal diameter of the spigot locating bore in the adaptor plate at two positions, 90° apart and approximately .25" in from the leading edge of the housing. The diameter shall be between 2.9995" and 3.0020". If a diameter greater than 3.0020" is measured, the bore shall be reclaimed in accordance with clause 3.

2. Spigot

(a) Measure the diameter of the spigot at two positions, 90° apart. The diameter shall be between 2.9975" and 2.9990". If the diameter is smaller than 2.9975" the spigot shall be reclaimed in accordance with clause 4.

(b) Check that the spigot is concentric to within .004" with the adjacent roller bearing bore in the runner casing. Reclaim spigot in accordance with clause 4 if required concentricity is not present.

3. Reclamation of Spigot Bore

(a) Machine out location bore to the dimensions shown on BR Drg. No. C-A1-14537 using the crankshaft flange location (DIA BB) for setting up purposes to ensure concentricity.

(b) Manufacture Spigot Bush to BR Drg. No. C-A1-14537 Item 1, BR Cat. No. 15/1129.

(c) Fit bush into spigot bore flush with the end of the housing and hone to the dimensions shown on BR Drg. No. C-A1-14537.

4. Reclamation of Spigot

(a) Apply weld repair to spigot, either by manual metal arc process using appropriate low hydrogen 10 SWG rod or by the use of a single pass on the Journal-master rotary welding machine.

CORRECT LOCATION OF FLUID COUPLING TO ENGINE
LEYLAND ALBION 902/903 SERIES ENGINES

4. Reclamation of Spigot (Cont'd)

(b) After welding, machine back to the dimensions shown on BR Drg. No. C-A1-14537 ensuring that concentricity with the roller bearing housing is acheived.

(c) Crack detect area around spigot to ensure freedom from flaws.

5. Assembly of Fluid Coupling to Engine

(a) Welded back-plate type.

Lay a straight edge across the welded backplate coupling face in such a position that it crosses the centre spigot shoulder YY, as shown in BR Drg. No. C-A1-14537. Check that a gap is present between straight edge and spigot shoulder, if so, this is correct.

If the shoulder is higher than the coupling face, measure the amountand stamp the dimensions on the end face of the centre spigot.

On assembly of fluid coupling to engine, fit a minimum of shims to BR Drg. No. C-A1-14537 Item 2, BR Cat. No. 15/1130 at the coupling face to a thickness greater than the protrusion of the spigot shoulder previously measured.

(b) Bolted-on skirt type.

Attach the skirt to the fluid coupling casing.

Proceed as in clause 5(a) except the straight edge is now laid across the coupling face of the bolted-on skirt.

NOTES:- The shims to BR Drg. No. C-A1-14537 Item 2 are of 1.0 mm thickness.

Fluid couplings supplied as seperate units for fitting at Depots to be accompanied by the correct number of shims to BR Drg. No. C-A1-14537 Item 2.

ASSEMBLY CHECKS

pection

PRE SUMP FITTING. INTERNAL EXAMINATION. CHECK THAT THE FOLLOWING HAVE BEEN CARRIED OUT.

1. Internal lubricating oil pipe connections are locked with wire.
2. Split pins are fitted to all main and big end nuts.
3. Pistons and rods are fitted correctly into the cylinders.
4. End float must be present at both small and big ends.
5. Valve timing marks, in line. (See Data Section Item 71).
6. Relationship of piston crown to crankcase top face, is correct. (See Data Section Item 74).

OTHER ASSEMBLY CHECKS FOLLOWING SUMP FITTING.

1. Fuel pump timing is correct to engine. (See Data Section Item 72).
2. Flywheel runout check. (See Data Section Item 73).

ENGINE COMPLETE. PRE-TEST CHECKS.

1. All main external components fitted correctly.
2. External nuts and bolts are secure and split pinned.
3. All hoses correctly clipped.
4. Stop solenoid can be manually operated.
5. Tab washers are correctly locked.
6. Colour codes, if any, are painted on the engine, also data plate correctly stamped.

AFTER TEST AND ENGINE SERVICEABLE, CHECKS.

1. Fluid coupling fitted, air pressure test to be carried out, gland and periphery joint to be checked for leaks.
2. Following the fitting of Electrical Equipment, examination to be carried out by Electrical Inspector.
3. Ensure all apertures are correctly covered.

ITEM NO.	COMPONENT		MINIMUM	MAXIMUM	REMARKS	ITEM NO.
	CYLINDER HEADS					
1	Pressure Test for Casting (Air)			30lb/in^2	Compressed air. Head submerged in water at temperature of 65° - 71°C (150-160°F).	1
2	Combustion Face - Distortion			0.003 in.	Face flashed at 0.003 in distortion. Amounts to be flashed off as necessary up to 0.015 in. max. Amount of metal removed to be stamped on face.	2
3	Valve - Inlet				3 lives (1½ engine lives)	3
	- Exhaust				2 lives (1 engine life)	
					After each life, the letter "O" to be marked on the valve stem above the collet groove.	
4	Valve Seats - Width		0.09375 in.	0.125 in.		4
5	Valve Seat Inserts					5
	Inlet - Standard	- Insert Diameter	2.8035 in.	2.8040 in.		
		- Recess Diameter	2.789 in.	2.800 in.	Cylinder Head Part No. 101 K19 A.B.C.	
	- 1st Oversize	- Insert Diameter	2.8235 in.	2.8240 in.		
		- Recess Diameter	2.814 in.	2.816 in.		
	- Standard	- Insert Diameter	2.7035 in.	2.7040 in.	Cylinder Head Part No. 101 K19 E.F.G.	
		- Recess Diameter	2.694 in.	2.696 in.		
	- 1st Oversize	- Insert Diameter	2.7235 in.	2.7240 in.		
		- Recess Diameter	2.714 in.	2.716 in.		

ITEM NO.	COMPONENT	MINIMUM	MAXIMUM	REMARKS	ITEM NO.
5 (Cont)	Valve Seat Inserts (Continued)				5 (Cont)
	Exhaust - Standard - Insert Diameter	2.453"	2.4535"	)	
	- Recess Diameter	2.448"	2.450"	) Cylinder Head Part No.	
	- 1st Oversize - Insert Diameter	2.473"	2.4735"	) 101 K19 A.B.C.	
	- Recess Diameter	2.464"	2.466"	)	
	- Standard - Insert Diameter	2.453"	2.4535"	)	
	- Recess Diameter	2.444"	2.446"	) Cylinder Head Part No.	
	- 1st Oversize - Insert Diameter	2.473"	2.4735"	) 101 K19 E.F.G.	
	- Recess Diameter	2.464"	2.466"	)	
	Guides - Stem Clearances - New Condition - Inlet	0.00225"	0.00475"		6
	- Exhaust	0.00375"	0.00625"		
	- Worn Condition - Inlet and Exhaust		0.010"		
	Springs - Inner			Renew when spring will compress to 1.13" under a load of less than 55lb. Free length 2.04".	
	- Outer			Renew when spring will compress to 1.385" under a load of less than 100lb. Free length 2.35".	
	Injector Hole - Fracture Length		0.750"	If fracture is not of an open nature, repair by 'Metalock' process.	8
	Valve Head Projection beyond Cylinder Head Face - Exhaust	0.032"	0.051"		9
	- Inlet	0.070"	0.089"		

DATA SECTION

ITEM NO.	COMPONENT	MINIMUM	MAXIMUM	REMARKS	ITEM NO.
	PISTON ASSEMBLIES				
10	Piston Ring Groove Widths - Top ring	-	0.132"		10
	- 2nd & 3rd rings	-	0.131"		
	- S.O.C. rings	-	0.256"		
	- Gudgeon Pin Clearance in Small End Bush - New	0.00075 in.	0.0015 in.		
	- Worn		0.003 in.		
11	Piston - Ring Gap - Top Ring (Chrome)	0.022 in.	0.029 in.		11
	- Top Ring (Plain - Cast Iron)	0.017 in.	0.024 in.		
	- Remaining Rings	0.017 in.	0.024 in.		
	Piston - Gudgeon Pin Clearance		0.0001 in.	Light hand push fit at room temperature.	
12	Connecting Rod - Twist		0.015 in.	Measured on mandrel at 9½ in. centres. Jig to Swindon Drawing W. 3571. Interference fit between connecting rod and little end bush to be 0.002 in.	12
	- Bend		0.005 in.		
	- Little End Bush Bore Diameter	1.8770 in.	1.8775 in.		
	- Large end bore diameter	3.665 in.	3.667 in.		
	- Large end to little end centres	11.9985 in.	12.0015 in.		
13	Big End Bearing - Step Sizes - Standard	3.5017 in.	3.504 in.		13
	S1	3.4917 in.	3.494 in.		
	S2	3.4817 in.	3.484 in.		
	S3	3.4717 in.	3.474 in.		
	S4	3.4617 in.	3.464 in.		
	S5	3.4517 in.	3.454 in.		
	- Diametral Clearance - New	0.00275 in.	0.005 in.		
	- Worn		0.010 in.		
14	Big End Bolts - Number of Lives		1		14
	- Torque Load		150 lb.ft.		
	- Weight		± 1 oz.	Variation between any two rods in a set.	
	- Elongation	0.006 in.	0.008 in.		

ITEM NO.	COMPONENT	MINIMUM	MAXIMUM	REMARKS	ITEM NO.
	CYLINDER BLOCK				
15	Pressure Tests for Casting (Air)		30 lbf/in^2	Block submerged in water at temperature of 65-71°C (150-160°F)	15
16	Bores - 901/902 Wet Type - Upper Register	6.400"	6.401"		16
	surface finish		N6	Oversizes available are 0.010", 0.020" and 0.030"	
	- Lower Register	6.250"	6.251"		
	surface finish		N5		
	- 903 Dry Type	5.812"	5.813"		
	surface finish		N6		
	- Recess Depth	0.399"	0.401"	Recess floor re-cut as necessary and shims fitted to obtain correct protrusion (item 19)	
	surface finish of recess floor		N6		
	- Permissible Ovality (all types)		0.002"		
	- Permissible Taper		0.002"		
	- Recess floor/bore squareness	90°	90° 30'		
17	Block Face - Distortion		0.003"	Regrind as necessary up to maximum 0.015". Amount of metal removed to be stamped on face	17
	surface finish		N7		

Continued .....

ITEM NO.	COMPONENT	MINIMUM	MAXIMUM	REMARKS	ITEM NO.
	CYLINDER BLOCK				
18	Cylinder Liners - Bore - 901/902 Wet Type	5.504"	5.50475"		18
	- 903 Dry Type	5.5035"	5.5045"		
	surface finish - all types		N6		
	- Outside Diameter - 901/902 Wet Type -				
	Upper Register	6.3995"	6.4005"		
	Lower Register	6.2495"	6.2505"		
	- 903 Dry Type	5.8135"	5.8145"		
	- Flange Thickness - 901/902 Wet Type	0.401"	0.402"		
	- 903 Dry Type	0.401"	0.403"		

ITEM NO.	COMPONENT	MINIMUM	MAXIMUM	REMARKS	ITEM NO.
	CYLINDER BLOCK (Continued)				
	Cylinder Liners - Protrusion - All Types - Nominal	0.003 in.	0.005 in.		19
	- Variation around periphery of any one liner		0.0005 in.		
	- Variation between any three liners under one head		0.001 in.		
	Cylinder Head Holding Down Studs - Torque Load - 5/8 in A.F. Nuts	220 lb.ft.			20
	- 1/2 in A.F. Nuts	100 lb.ft.			
	Camshaft Bearing Bush - Diameter - Front	1.62475 in.	1.62925 in.		21
	- Intermediate	2.69825 in.	2.70225 in.		
	- Rear	1.62475 in.	1.62925 in.		
	Main Bearing Housing				22
	Diameter	4.3495 in.	4.3505 in.		
	Misalignment		0.002 in.		

ITEM O.	COMPONENT		MINIMUM	MAXIMUM	REMARKS	ITEM NO.
	CAMSHAFT					
3	Alignment at Centre Main Journal - Deviation			0.005 in.		23
4	Cam Lobe - Dimension (Nose to Back of Cam)		2.18257 in.	-		24
5	Bearing Journal Diameter - Front and Rear - New		1.625 in.	1.6255in.		25
	Intermediate - New		2.6965 in.	2.6975in.		
	Front and Rear - Worn		1.623 in.	1.6235in.		
	Intermediate - Worn		2.694 in.	2.6900in.		
6	Camshaft End Float		0.002 in.	0.009 in.		26
7	Cam Follower - Hardness (Vickers)		590			27
	CRANKSHAFT					
8	Crankshaft Alignment at Centre Journal - Deviation		0.000 in. Above ± 0.003 in.	± 0.003in.	Reuse Regrind in accordance with step sizes.	28
9	Main Journals, and Crankpins -	Taper		0.005 in.	If exceeded, regrind to next service standard.	29
		Ovality		0.003 in.		

ITEM NO.				MINIMUM	MAXIMUM	REMARKS	ITEM NO.
	CRANKSHAFT (Continued)						
29 nt)	Main Journals, Bearings and Crankpins -		(Colour) (Code)			Colour Code:- Main Journal Diameter - Painted on coned centre at drive end of crankshaft. Crankpin Diameter - Painted on parallel bore at drive end of crankshaft.	29 (Cont)
	Main Journal Diameter (901H9 and 903Ex901H9)	Standard	(-)	3.9005in	3.9010in		
		S1 (0.010in)	(Yellow)	3.8905in	3.8910in		
		S2 (0.020in)	(Green)	3.8805in	3.8810in	Crankshaft to be renitrided.	
		S3 (0.030in)	(Blue)	3.8705in	3.8710in		
		S4 (0.040in)	(White)	3.8605in	3.8610in	Crankshaft to be renitrided.	
		S5 (0.050in)	(Black)	3.8505in	3.8510in		
	- Main Journal Diameter (902/11 and 903Ex902/11)	Standard	(-)	4.150in	4.1505in		
		S1 (0.010in)	(Yellow)	4.140in	4.1405in		
		S2 (0.020in)	(Green)	4.130in	4.1305in	Crankshaft to be renitrided.	
		S3 (0.030in)	(Blue)	4.120in	4.1205in		
		S4 (0.040in)	(White)	4.110in	4.1105in	Crankshaft to be renitrided.	
		S5 (0.050in)	(Black)	4.100in	4.1005in		
	- Crankpin Diameter (All Types)	Standard	(-)	3.4983in	3.4990in		
		S1 (0.010in)	(Yellow)	3.4883in	3.4890in		
		S2 (0.020in)	(Green)	3.4783in	3.4790in	Crankshaft to be renitrided.	
		S3 (0.030in)	(Blue)	3.4683in	3.4690in		
		S4 (0.040in)	(White)	3.4583in	3.4590in	Crankshaft to be renitrided.	
		S5 (0.050in)	(Black)	3.4483in	3.4490in		
0	Flywheel Flange Face Runout				0.004in		30
31	Flywheel Coupling Bolts - Torque Load			160 lb. ft.			31

ITEM No.	COMPONENT	MINIMUM	MAXIMUM	REMARKS	ITEM NO.
	MAIN BEARINGS				
2	Diametral Clearance - New	0.0035in.	0.0065in.		32
	- Worn		0.007 in.		
	Main Bearing Sizes - Standard				
	S1 (-0.010 in)				
	S2 (-0.020 in)				
	S3 (-0.030 in)				
	S4 (-0.040 in)				
	S5 (-0.050 in)				
	Cap Nuts - Torque Load	230 lb.ft.			
3	Centre Bearing - End Float - New	0.002 in	0.010 in.		33
	- Worn		0.012 in.		
	ROCKER GEAR				
4	Rocker Arm Pad			Pad to be ground until all wear marks are removed. Ensure correct profile. Surface finish to be 16 C.L.A.	34
6	Rocker Shaft Alignment - Deviation		0.008 in.		36

COMPONENT	ITEM NO.
FUEL INJECTION PUMP	37

Calibration :-

(Delivery Quantities are measured to cubic centimetres per 100 strokes)

7 mm Delivery Valve - Part No. 7118/239

5 mm Delivery Valve - Part No. 7097/182.

Camshaft Speed in R.P.M.	Plunger Diameter	Delivery at Given Control Rod Openings						Camshaft Speed in R.P.M.	Plunger Diameter	Delivery at Given Control Rod Openings					
		6mm		9mm		12mm				6mm		9mm		12mm	
		Min.	Max.	Min.	Max.	Min.	Max.			Min.	Max.	Min.	Max.	Min.	Max.
200	9mm	0.6	1.5	-	-	-	-	200	9mm	1.4	2.1	-	-	-	-
600	9mm	-	-	7.8	8.7	-	-	600	9mm	-	-	7.5	8.4	-	-
900	9mm	-	-	-	-	13.1	14.6	900	9mm	-	-	-	-	13.2	14.3

Balanced at top limit at 600 r.p.m. - 9mm control rod open maximum. Maximum fuel setting 14.2 cc at 600 r.p.m. per 100 strokes (to develop 200 b.h.p.)

See C.A.V. Publication No. 2065.

ITEM NO.	COMPONENT	MINIMUM	MAXIMUM	REMARKS	ITEM NO.
	FUEL INJECTION PUMP (Continued)				
38	Tappet Assembly - Plunger Head Clearance	0.5mm		Available shim sizes:-0.3mm to 1.4mm in 0.1mm increments.	38
	- Phase Deviation	$+\frac{1}{2}^{\circ}$			
39	Camshaft - Alignment Deviation - Governor End		0.003 in.		39
	- Coupling End		0.002 in.		
40	Camshaft - End Float	0.05mm	0.10mm	Available shim sizes:-0.15mm to 0.40mm in 0.05mm increments.	40
41	Camshaft Coupling Nut - Torque Load	50lb.ft.			41
42	Control Rod and Bushes- Lift		0.001 in.		42
	- Locating Plate Clearance	0.002 in.			
43	Delivery Valve Holder - Torque Load	40lb.ft.			43
	GOVERNOR				
44	Test Data - Cut In - Commence	170r.p.m.			44
	Complete	235r.p.m.			
	Cut Out - Commence		950r.p.m.		
	Complete		1000r.p.m.		
45	Yoke - Clearance	0.0015 in.	0.005 in.	Available shim sizes:-1.9mm, 1.95mm and 2.05mm.	45
	FEED PUMP				
46	Test Data - Delivery Time for 560cc at 200 r.p.m. against 4 to 5lb/sq.in.	30secs.	45secs.		46

ITEM NO.	COMPONENT	MINIMUM	MAXIMUM	REMARKS	ITEM NO.
	INJECTORS (C.A.V.).				
7	Needle Lift	0.4 mm	0.7 mm		47
8	Test Data:-				48
	Breaking Pressure	175atmos			
	Back Leak Time from 150 to 100 atmospheres	6 secs.	15 secs.	Selective assembly of needles to obtain back leak time.	
	Injector Clamp - Torque Load		35lb.ft.		
	FLUID COUPLING				
9	Rear Casing (with Runner Casing and Shaft) - Runner Shaft - Runout		0.005 in.	Measured on pulley face adjacent to periphery.	49
	Bearing - End Float		0.010 in.		
9a	Bolts (high tensile) Mounting plate to flywheel and mounting plate to coupling. Torque load.		35lb.ft.	Approved self locking or stiff nuts to be used.	49a
0	Output Flange Eccentricity - Engine Mounted		0.005 in.		50
	" " Wobble - " "		0.005 in.		
1	Front Casing Periphery Eccentricity - Engine Mounted		0.015 in.		51
	" " " Wobble - " "		no limit		
	MECHANICAL INTERNAL COMPONENTS				
	Oil Pump and Drive				
2	Clearance of Driving Spindle in Pump Body	0.001 in.	0.002 in.		52
	Clearance between Spindle and Bush	0.001 in.	0.002 in.		
3	Clearance between Idler Gear and Spindle	0.0022 in.	0.0037 in.		53
	Initial Backlash between Skew Gears and Camshaft	0.008 in.	0.012 in.		

ITEM NO.	COMPONENT	MINIMUM	MAXIMUM	REMARKS	ITEM NO.
	MECHANICAL INTERNAL COMPONENTS (Continued)				
	Oil Pump and Drive (Continued)				
54	Backlash between Pump Gears	0.022 in	0.026 in		54
	End Clearance of Gears in Pump Body	0.003 in	0.008 in		
55	Push Rods - Misalignment		0.020 in		55
56	Timing Wheels-Diametral Clearance - Bush to Gears	0.001 in	0.0035 in		56
	-Diametral Clearance - Bush to Spindles	0.001 in	0.0035 in		
	-Thrust Washers - End Float		0.012 in		
	-Idler Gears - Main Bearing Cap Nut - Torque Load	160 lb.ft.			
	-Idler Gears - Crankshaft to Camshaft Nut - Torque Load	160 lb.ft.			
	MECHANICAL EXTERNAL COMPONENTS				
58	Pipe Work (Lubricating Oil) - Test Pressure	150 lb/in^2			58
59	Damper Retaining Nut and Stud - Torque Load	330 lb.ft.			59
	ANCILLARY COMPONENTS				
60	Right Angle Drive Unit - Bevel Gear Backlash	0.004 in	0.008 in	Available shim sizes:- 0.0025in, 0.005in and 0.010in	60
	Air Compressor				
61	Cylinder Block - Bores - New Size	2.625 in	2.626 in		61
	- Worn		+0.005 in	Fit new standard rings.	
		0.005 in	0.010 in	Bore out to 0.010 in and fit new 0.010 in oversize piston and rings.	
		0.010 in	0.015 in	Fit new oversize rings.	
	Surface finish	25 micro-inch CLA	45 micro-inch CLA		

ITEM	COMPONENT	MINIMUM	MAXIMUM	REMARKS	ITEM NO.
	ANCILLARY COMPONENTS (Continued)				
	Air Compressor (Continued)				
	Valve Seat Inserts	1.502 in	1.503 in	Recess 1.500 in diameter x 0.500 in.deep. Material EN.58.	62
	Connecting Rods - Length between Centres	4.123 in	4.127 in.		63
	Piston Rings - Gap - New	0.006 in	0.008 in.		64
	- Worn		0.012 in.		
	Crankshaft - Misalignment		0.003 in.		65
	Heat Exchanger - Test Pressure (Air)	30 lb./in.^{2}		Oil side subjected to this pressure when complete Block Assembly immersed in water at a temperature of 65-70°C (150-160°F)	66
	ELECTRICAL EQUIPMENT				
	Wiring Harness - Insulation Test	3 megohms at 100 volts			67
	Pressure Switches (Lubricating Oil) - Setting	5 lb/in.^{2}	6 lb/in^2		68
	Tacho Generator - Test Data		±1% of 40 volts at 667 r.p.m. with a load of 22.2m/a	For high reading reduce magnetism. For low reading increase magnetism.	69
	Stop Solenoid - Resistance - Pull in Coil	2 ohms			70
	- Hold in Coil	44 ohms			

TEM O.	COMPONENT	MINIMUM	MAXIMUM	REMARKS	ITEM NO.
	ASSEMBLY CLEARANCES AND MEASUREMENTS				
	Valve Timing - Marks			Camshaft gear and timing plate checked for alignment of timing marks. No. 6 piston T.D.C. on firing stroke and No. 1 cylinder cams on the rock.	71
	- Tappet Clearance		0.020in.	Inlet and Exhaust	
	Fuel Pump Timing - Marks			Pointers checked for alignment marks on flywheel and fuel pump, i.e. flywheel timing mark 6.375in. B.T.D.C. No. 1 piston on firing stroke.	72
	Flywheel Periphery Runout		0.006 in.		73
	Piston/Cylinder Block (Top Face) Assembly Limits	-0.006in.	+0.006 in.		74

AMENDMENT NO. 151 D.M.U. 200 H.P. ENGINES.

JULY, 1972.

DATA SECTION

ITEM NO.	COMPONENT	SIZES	REMARKS	ITEM NO.
	CAM (A.E.C. Pt. No. K13103)			75
	Dimension across flats (nominal	3.990 in.		
	(minimum	3.953 in.		
	Taper and variation between flats	.001 in. max.		
	Fit of Splines (Circumferential	.006 in. max.		
	with Yoke (K2/0426) (Lift	.004 in. max.		
	OUTER RACE (A.E.C. Pt. NO. K13112)			76
	Finished inside diameter (nominal	5.000 in.		
	(maximum	5.012 in.		
	Minimum ground diameter before plating	5.040 in.		
	Reclamation :- Deposit (Nominal)	0.020 in.	Hard chromium plate to BS.4641 with low temperature stress relieving and hydrogen de-embrittlement.	
	Minimum Reclaimed Diameter	4.975 in.		
	Taper and Ovality	.001 in. max.		
	FITTING OF CAM AND OUTER RACE			77
	Difference between outer race inside diameter and across-flats measurement of cam:-	$1.013 \pm .009$ in.	Selective fitting essential.	
	END FLOAT OF ASSEMBLY			
	Minimum	.010 in.		
	Maximum	.020 in.		

ITEM NO.	COMPONENT	SIZE	REMARKS	ITEM NO.
79	CAM			79
	Across-flats dimension (Nominal Maximum	5.982 in		
	Across-flats dimension (Minimum after grinding	5.945 in		
	Taper and Variation between flats	.001 in max		
	Fit of splines with yoke (Circumferential	.008 in max		
	Fit of splines with yoke (Lift	.010 in max		
80	OUTER RACE			80
	Finished			
	Internal diameter (Nominal	8.000 in		
	Internal diameter (Maximum after grinding	8.021 in		
	Internal diameter (Maximum after reclamation	7.984 in		
	Maximum ground diameter before plating	8.040 in		
	Reclamation deposit (nominal)	.020 in	Hard Chromium Plate to BS 4641 with temperature stress-relieving & hydrogen de-embrittlement.	
	Taper and Ovality	.001 in max		
81	ROLLERS			81
	Degrease using White Spirit (B.R.Cat.No.27/29300)			
	Diameter (Nominal	1.000 in		
	Diameter (Minimum	.999 in		
82	FITTING OF CAM AND OUTER RACE			82
	Difference between outer race internal diameter and across-flats dimension of cam.	2.026 ± 0.013 in	Selective fitting essential.	

DATA SECTION.

"Schedule of Lubricants"

COMPONENT	LUBRICANT	B.R. CAT. NO.
rine sump) el pump sump) el pump governor) gine Air Cleaner)	Shell Talona 945 or Esso Estor HD30	27/20550 27/18600
uid Coupling	**Shell SFR Hydraulic Fluid**	27/11515
rottle Motor and Linkage	B.R. Spec. 673 Lithium Base Grease	27/1350
eewheel & Freewheel Shaft) iversal Joints) rdan Shaft Joints & Splines) n Drive Joints & Splines)	Molybdenum Disulphide Grease	27/4150
ght Angle Fan Drive Gearbox	Sheel Talona 972 or Esso Estor HD40.	27/20560 or 27/15765

D.M.U. 200 H.P. ENGINE

T E S T S C H E D U L E

SECTIONS

1. Test Recording.
2. Pre-Test Procedure.
3. Running-In Procedure.
4. Acceptance Test Procedure.
5. Power and Operating Data.

1. TEST RECORDING.

1.1 The test will be recorded on Form No.DTS/1 (See Sheet 2 (a))
Running in - one copy
Acceptance Test - two copies

1.2. Readings will be recorded at the time intervals indicated:-

READING	INTERVAL
Time	At each incident
Brake Load (lb).	10 Minutes
Engine Speed (rev/min)	10 Minutes
Brake Load, $b.h.p._o$ & $b.h.p._c$	At final readings of run-in At each change in running conditions When taking power curve readings. At final reading of endurance run.
Lubricating Oil.	
Pressure ($lbs/in.^2$)	10 Minutes
Temperature (^oF).	10 Minutes
Engine Coolant	
Temperature-in (^oF)	10 Minutes
Temperature-out(^oF)	10 Minutes

READING	INTERVAL
Air Intake Temperature (^{o}F)	10 Minutes
Fuel Consumption (lbs)	At final readings of run-in At each change in running conditions When taking power curve readings At final reading of endurance run
Barometer (m.m.Hg.)	4 hours

1.3 All additional incidents will be recorded as they occur.

1.4 Where climatic conditions differ from 760 m.m. barometric pressure and 60^{o}F (16^{o}C) intake air temperature, a correction factor, obtained from the Horse Power Correction Chart, No. J.T.S.0287, (See Sheet 2 (b)) will be used to obtain the corrected b.h.p.

U. 150/200 H.P. ENGINES

TEST SCHEDULE

SHEET 2 (a)

NO. D.T.S.1

LOCO. WORKS.
DIESEL TESTING STATION
D.M.U. RAILCAR ENGINE TEST REPORT

TE	TIME		PERIOD	POWER				LUB. OIL		COOLANT		AIR	FUEL CONSUMPTION			
	H	M	M	REV/MIN N	BRAKE LOAD LB W	bhp $\frac{WN}{K}$	bhp_c	PRESS LB/IN^2	TEMP °F.	IN °F.	OUT °F.	INLET TEMP °F.	TIME S	WT LB	LB $\frac{b.h.p.}{HR}$	

FUEL OIL

LUB. OIL

DYNAMOMETER NO.:

DYN. CONSTANT (K)-

BAROMETER

CORRECTION FACTOR

REV/MIN.(IDLING)

REV/MIN.(RUNAWAY)

b.h.p. CORRECTED TO-
m.m. °F

TESTER.....
CHECKED.....

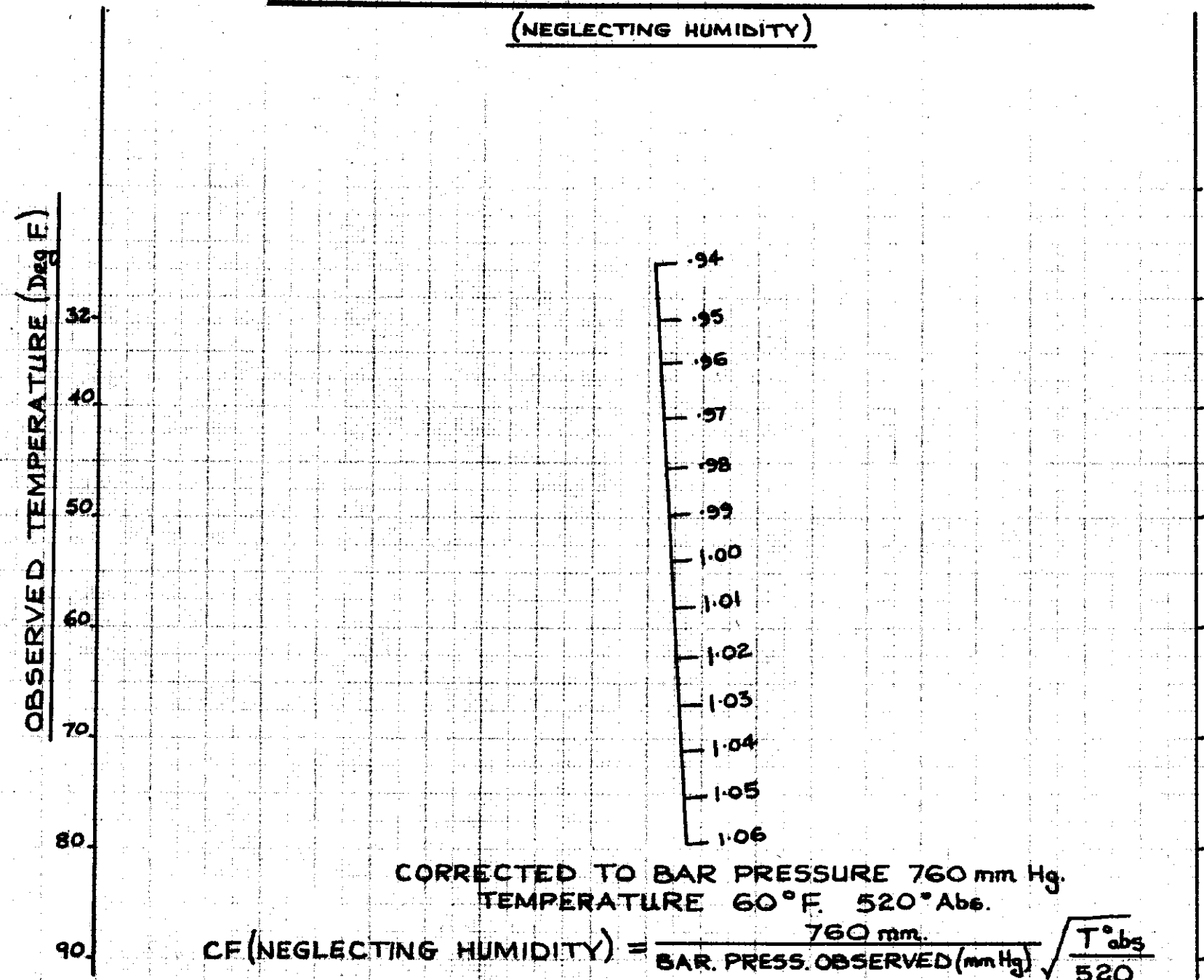
FUEL PUMP NO.

TYPE	MAKE

SHEET OF SHEETS	ENG.SERIAL NO.

HORSE POWER CORRECTION CHART.

(NEGLECTING HUMIDITY)



CORRECTED TO BAR PRESSURE 760 mm Hg.
TEMPERATURE 60° F. 520° Abs.

$$CF(\text{NEGLECTING HUMIDITY}) = \frac{760\ \text{mm.}}{\text{BAR. PRESS. OBSERVED (mm Hg)}} \sqrt{\frac{T°_{abs}}{520}}$$

PRE-TEST PROCEDURE

2.1 Engine to be coupled to the dynamometer.

2.2 Fill with specified oil:-

PART	OIL CAPACITY
Engine Sump	8 galls.
Fuel Pump Sump	½ pint
Fuel Pump Governor	½ pint
Engine Air Cleaner	5 pints
Right Angle Fan Drive	½ pint

2.3. Fill engine with water and vent air by release valve.

2.4. Fit air cleaners to engine (oil bath type) and compressor air intakes. (Vokes 3 ply type A.O.I.) These must be cleaned at regular intervals.

2.5. Bar engine over for 3 revolutions to ensure freedom of rotation.

2.6. Check engine for loose joints, leaks etc.

2.7. Check coupling bolts are tight.

2.8. Check throttle and shut-down controls function freely. Connect 24V supply to stop solenoid and set for use as an emergency stop during the complete test run.

2.9. Check engine mounting bolts are tight.

2.10. Check tension of fan belts.

2.11. Vent fuel system.

2.12. Connect 24 volt supply to STOP SOLENOID and check that fuel pump rack is taken to the NO FUEL position when the solenoid is energised, and fully returns when de-energising.

TEST SCHEDULE

UNNING-IN PROCEDURE

.1. Motor engine for 5 minutes, checking oil pressure and that oil is flowing from rockers. (Current checked at commencement of 5 minutes and at the end of 5 minutes should show a fall proving that engine is freeing and not seizing). A 40 h.p. phase 400V motor has a current of 52A nominal falling to 48A nominal in 5 minutes.

.2. Record starter motor ammeter readings at commencement and end of 5 minutes.

.3. Start engine, check for leaks and satisfactory running.

.4. Adjust oil pressure relief valve during run-in to give a pressure within the limits laid down in Paragraph 5.1.

.5. Run engine as follows, recording as laid down in Paragraph 1.2.:-

TIME MINUTES	SPEED rev/min	BRAKE LOAD (lb)	B.H.P.
15	500	NIL	NIL
30	1000	15	37.5
30	1200	17	51
30	1400	18	63
30	1600	18	72
30	1600	23	92
30	1600	28	112
30	1600	33	132
30	1800	33	148.5
30	1800	38	171
2	1800	FULL LOAD	200 +1 -0
TOTAL 4 hrs. 47m.			

3.6. During 2 minutes run on full load at 1800 rev/min, record brake load, time to consume 1lb. of fuel then permit the engine to runaway from full load, having removed full load, check the runaway speed. These readings to be taken before any alterations are made to the fuel pump.

3.7. Check maximum engine speed on no load and "run-down" time from 1800 to 400/430 rev/min.

3.8. Run engine at 400/430 rev/min for 2 minutes and check for leaks, etc.

3.9. Stop engine, remove and check injectors. For correct torque loadings see Data Section Item 48.

3.10. Injector breaking pressure:-

C.A.V. - 175 atmos. (2570lb./in.^{2})

3.11. Remove oil pipes and rocker gear and check torque loading of cylinder head nuts. (See Data Section Item 20)

3.12. Check and reset tappets hot:-

Inlet and Exhaust - 0.018".

3.13. Check injection timing - 30° B.T.D.C.

ACCEPTANCE TEST PROCEDURE

4.1. Power & Fuel Consumption Test.

4.1.1. Check oil level and top up if necessary.
4.1.2. Start engine and warm up.
4.1.3. Check for leaks, etc.
4.1.4. Set idling stop.
4.1.5. Set idling damper.
4.1.6. Set maximum fuel stop.
4.1.7. With throttle fully open, record brake load and time taken to use 1lb. of fuel at 1000, 1200, 1400, 1600 and 1800 rev/min.

4.2. Governor Check

4.2.1. With throttle fully open, record brake load at 1850 rev/min.
4.2.2. Record maximum engine speed with no brake load.
4.2.3. When throttle is suddenly closed, record time taken for engine speed to fall from 1800 to 400/430 rev/min.
4.2.4. Record idling speed.

4.3. Endurance Run

4.3.1. With throttle fully open and brake load adjusted to give an engine speed of 1800 rev/min. run for one hour, record as laid down in Paragraph 1.2.
4.3.2. Check that stop solenoid shuts engine down completely from
i. 1800 rev/min FULL LOAD
ii. Idling NO LOAD
iii. Runaway speed.
4.3.3. Run engine at 400/430 rev/min. for 5 minutes and check for leaks, etc.
4.3.4. Record maximum and minimum lubricating oil pressures.
Maximum lubricating oil pressure = maximum reading during run laid down in Paragraph 4.3.1.
Minimum lubricating oil pressure = reading at end of run laid down in Paragraph 4.3.2. with throttle closed against idling stop.
4.3.5. Stop engine and observe pressure at which lubricating oil shut down switch operates.
4.3.6. Drain cooling water and remove engine from bed.
4.3.7. Drain oil from engine sump and filter. Remove filter from engine, examine, clean and replace.
All open apertures to be sealed.

5. POWER AND OPERATING DATA

5.1. Operating limitations:-

Engine speed

1800± 5 rev/min. at 200 b.h.p.

2000-2100 rev/min. maximum speed, no load
400/430 rev/min. Idling Speed.

Engine coolant temperatures.

Outlet - 170° - 185°F. (77°-85°C)
Inlet - Within 20°F (11°C) of outlet.

Engine lubricating oil.

Temperature - 165° - 190°F. (74°-88°C)
Pressure -

At 1800 rev/min and 165°F (74°C) - 45/55lb./in.^{2}.
At Idling and 165°F (74°C) - 10lb/in^2. minimum.

5.2. Power and fuel consumption requirements, under standard conditions of 760 m.m. barometric pressure and 60°F (16°C) air temperature, on full throttle are:-

Rev/min	BRAKE LOAD lb.	b.h.p.$_c$	TIME TO USE 1b. FUEL seconds	lb/b.h.p. Hr.
1000	45.0	114.8	79.0	.397
1200	47.0	143.9	63.7	.393
1400	46.8	167.0	56.4	.382
1600	46.2	188.3	50.5	.378
1800	43.5	200.0	45.75	.394

3. Engines will be accepted for service with an output of 200^{+1}_{-0} b.h.p. at 1800 rev/min after complete overhaul.

4. The maximum fuel stop must be set so that the engine uses 1 lb. of fuel when developing 200 b.h.p. at 1800 rev/min in approximately 46-47 seconds.

5. The time taken for an engine to slow down from 1800 rev/min to 400/430 rev/min when the throttle is suddenly closed to be 7 seconds or less.

6. Engine timing and tappet settings.

Firing Order	1.5.3.6.2.4.
Valve Timing	
Inlet Valve Opens	10° B.T.D.C.
Injection Timing	30° B.T.D.C.
Tappet Adjustment	
Inlet	.020" cold .018 hot
Exhaust	.020" cold .018" hot

7. Injector breaking pressure :-

175 atmos. (2750lb/in.^{2})

TEST SCHEDULE

5.8. If the revised excess fuel setting has not been applied or the maximum fuel stop was adjusted in excess of $\pm \frac{1}{2}$ turn, the following procedure shall be applied.

(i) Remove cap from excess fuel stop and slacken locknut.

(ii) Run engine at any speed between idling and maximum with full throttle applied.

(iii) Screw in excess fuel adjustment screw until engine power begins to fall. Retract adjustment screw until full power is just restored.

(iv) Retract the adjustment screw a further 5 full turns.

(v) Tighten locknut, replace cap and apply lead seal.