

MF35

service
manual

Service Manual for all MF35 tractors

MASSEY-FERGUSON

35 TRACTOR

WORKSHOP SERVICE MANUAL

SECTION A

INTRODUCTION

FE-35 Tractor

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FE-35 TRACTOR

SECTION B

GENERAL SPECIFICATION AND DATA

This specification initially gives data of the normal width agricultural tractor, less engine. For Engine Data see pages B19 (Petrol), B27 (V.O.), B29 (L.O.), and B29 (23C Diesel), and B43, 3-A-152 Diesel.

For data of other FE-35 Tractors, Vineyard, Industrial, etc. see Section T.

Tractor Codes:		Engines—continued	High Altitude Petrol H
Chassis	Standard S		Diesel (23C) D
	Vineyard V		Diesel (3-A-152) N
	Industrial J		Vaporising Oil K Lamp Oil L
Engines	Petrol G	Other Variations	Single Clutch F
			Dual Clutch M

The De Luxe version of the Tractor is fitted with Dual Clutch, live P.T.O., Tractormeter, and cushion seat.

Overall Dimensions

Wheelbase	72" (1830 mm.)
Normal Track	Front — 48" (1219 mm.)
	Rear — 52" (1320 mm.)
Track Adjustment	Front — 48" — 80" (1219 mm. — 2032 mm.)
	Rear — 48" — 76" (1219 mm. — 1930 mm.)
Turning Circle Diameter	Using Independent Brakes 17' 6" (5334 mm.)
	Without Brakes 19' 3" (5867 mm.) (with track widths 48" front and rear).
Ground Clearance	Under centre — 12 $\frac{3}{4}$ " (321 mm.)
	Under axle — 21" (533 mm.)
Overall Length	117" (2972 mm.)
Overall Width	At normal track 64" (1630 mm.)
Overall Height	54" (1372 mm.)

Tyres

Tyre Pressures	Front — 4 × 19 — 26 lbs. (1.8 kg.)
	Rear — 10 × 28 — 12 lbs. (0.8 kg.)

Weight (with fuel, oil and water)

	Basic Model	De Luxe Model
Diesel (23C)	3158 lbs. (1432 kg.)	3198 lbs. (1451 kg.)
Diesel (3-A-152)	3175 lbs. (1440 kg.)	3185 lbs. (1445 kg.)
Carburettor	2982 lbs. (1352 kg.)	3022 lbs. (1371 kg.)

Fill-Up Data

Engine Sump	12 pints (6.8 litres)
Transmission	6.6 Imp. gallons (30.28 litres)
Air Cleaner	$\frac{1}{2}$ pint (.43 litres)
Steering	1.8 pints (.946 litres)
Belt Pulley	1 $\frac{1}{2}$ pints (.852 litres)

				Cooling System	Fuel Tanks
Diesel (23C) ...	...	...	...	15 pints (8.5 litres)	7½ Imp. gallons (34 litres)
Diesel (3-A-152) ...	...	...	...	10½ pints (5.96 litres)	8½ Imp. gallons (39 litres)
Petrol ...	...	...	...	15 pints (8.5 litres)	9½ Imp. gallons (42 litres) including 1 Imp. gallon (4.5 litres) reserve.
V.O. ...	...	...	...	15 pints (8.5 litres)	V.O. — 8½ Imp. gallons (37.5 litres)
L.O. ...	...	...	...	17 pints (9.66 litres)	Petrol — 1 Imp. gallon (4.5 litres)
					L.O. — 8¼ Imp. gallons (37.5 litres)
					Petrol — 1 Imp. gallon (4.5 litres)

Performance	Diesel		Petrol		V.O.	L.O.
	23C	3-A-152*	6.0 : 1	6.6 : 1		
Brake H.P. (Bare Engine) ...	37.25	37	37.25	38.0	30.5	29.0
Belt H.P. (Bare Engine) ...	35.9	—	34.5	36.2	28.8	26.3
Drawbar H.P. ...	31.5	—	29.5	30.5	23.3	20.7
H.P. available at P.T.O. ...	34	35	34	35	27.5	26

*Subject to official confirmation

TIGHTENING TORQUES

Front Axle	lbs./ft	kg./m.
Centres to Right-hand and Left-hand		
Axles	90 — 100	12.443 — 13.83
Spindle Arm	45 — 50	6.221 — 6.913
Radius Rod to Axle	90 — 100	12.443 — 13.83
Clamp—Steering Drag Link	6 — 8	.830 — 1.106
Front Axle Pin	75 — 80	10.369 — 11.060
Tool Box to Radius Arm	10	1.383
Front Engine Support	75 — 80	10.369 — 11.060
Rear Axle		
Battery Carrier to Axle	45 — 50	6.221 — 6.913
P.T.O. Bearing Retainer	45 — 50	6.221 — 6.913
Differential Case	47 — 53	6.498 — 7.328
Crown Wheel	80 — 90	11.060 — 12.443
Oil Trough, Differential Housing	6 — 8	.830 — 1.106
Bearing Retainer Stud	45 — 50	6.221 — 6.913
Check Chain Anchor	45 — 50	6.221 — 6.913
Step Board Attachment	45 — 50	6.221 — 6.913
Fenders and Wheels		
Front Wheel Hub	55 — 60	7.604 — 8.295
Rim to Disc	90 — 100	12.443 — 13.83
Wheel Disc—Rear	90 — 100	12.443 — 13.83
Fenders to Axle	60 — 70	8.295 — 9.678
Brake and Clutch Linkage		
Shoulder Bolt, Clutch Pedal	24 — 26	3.318 — 3.595
Left Hand Brake Pedal Attachment	45 — 50	6.221 — 6.913
Clutch Pedal	45 — 50	6.221 — 6.913
Combined Brake Arm	45 — 50	6.221 — 6.913
Centre Housing		
Axle Shaft Housing to Centre		
Housing— $\frac{1}{2}$ " Studs	70 — 75	9.678 — 10.369
Housing— $\frac{7}{16}$ " Studs	45 — 50	6.221 — 6.913
Hydraulic Lift Cover (Seat Studs)	45 — 50	6.221 — 6.913
Upper Link Attachment	45 — 50	6.221 — 6.913
Hydraulic Lift Arm	30 min.	4.148 min.
Hydraulic Lift Cover	45 — 50	6.221 — 6.913
Side Cover to Centre Housing	30 — 35	4.148 — 4.839
Transmission Case		
Steering Housing to Transmission Case		
Case	30 — 35	4.148 — 4.839
Steering Tube Housing Steering Unit	24 — 26	3.318 — 3.595
Starter Motor to Case (Diesel)	45 — 50	6.221 — 6.913
Transmission Case to Engine	45 — 50	6.221 — 6.913
Radius Rod to Transmission Case	45 — 50	6.221 — 6.913
Centre Housing to Transmission Case	45 — 50	6.221 — 6.913
Transmission Case to Engine	45 — 50	6.221 — 6.913
Starter Motor to Case (Petrol)	45 — 50	6.221 — 6.913
Hydraulics		
Valve Chamber Clamp Bolts.	50 — 55	6.913 — 7.604

DIMENSIONS AND TOLERANCES

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Transmission					
Selector Mechanism					
Shifter Rail Dia. ... ..	.7475	18.986			
	.7465	18.961			
			.004	.1016	
			.001	.0254	
Shifter Rail: Bore in Casing	.7485	19.012			
	.7505	19.063			
Plunger Spring Details ...	Free Length $1\frac{1}{32}$ " (26.19 mm.)				
	Solid Length .68" (17.27 mm.)				
	Fitted Load 15 lbs. \pm 1 lb. (6.80 kg. \pm .454 kg.)				
	Nominal fitted length .81" (20.57 mm.)				
Thickness of Change Speed Shifter Forks at Pressure Faces ... ..	.308	7.823			
	.304	7.722			
			.010	.254	
			.002	.0508	
Width of Groove in Coupling Connectors ... ..	.314	7.976			
	.310	7.874			
Thickness of Planetary Shifter Fork at Pressure Face ...	.308	7.823			
	.304	7.722			
			.010	.254	
			.002	.0508	
Width of Groove in Planetary Coupling ... ..	.314	7.976			
	.310	7.874			
Sliding Spur Gears					
Mainshaft: Spline for Inter- mediate and High Speed and Low Speed Gears ...	18 teeth	Minor Diameter	1.6913	42.959	
		Major Diameter	1.6915	42.964	
			1.965	49.911	
			1.960	49.784	
Spline in Mainshaft Gears ...	18 teeth	Minor Diameter	1.700	43.18	
		Major Diameter	1.705	43.31	
			2.0240	51.410	
			2.0390	51.791	
Countershaft Spline for Gears	17 teeth	Minor Diameter	1.9710	50.063	
		Major Diameter	1.9535	49.619	
			2.2398	56.891	
			2.2328	56.713	
Spline in Countershaft Gears	17 teeth	Minor Diameter	2.005	50.927	
		Major Diameter	2.000	50.800	
			2.250	57.150	
			2.260	57.404	
Gearbox Ratios:					
Constant Mesh P.T.O. and Transmission Gears Ratio: 2.78 : 1					
Sliding Spur Gears	1st	3 : 1			
	2nd	2 : 1			
	3rd	1.09 : 1			
	Reverse	2.20 : 1			
Epicyclic Reduction Unit ...	4 : 1				
Backlash between mating gears	.003"-.007" (.076-.178 mm.).				
Endfloat	Shafts are supported in ball bearings, require no shims, pre-load or adjustment.				

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Main Shaft Front Bearing					
Housing Bore for Bearing ...	3.1495	79.997			
	3.1501	80.013			
			-.0001	-.003	
			+.010	+.254	
Bearing Ext. Dia. ...	3.1496	80.000			
	3.1491	79.987			
Bearing Int. Dia. ...	1.5743	39.987			
	1.5748	40.000			
			-.0009	-.023	
			+.0001	+.003	
	1.5752	40.010			
	1.5747	39.997			
Main Shaft Rear Bearing					
Housing Bore for Bearing ...	3.5432	89.997			
	3.5440	90.017			
			+.0013	+.033	
			-.0001	-.003	
Bearing Ext. Dia. ...	3.5433	90.000			
	3.5427	89.985			
Bearing Int. Dia. ...	1.9685	50.000			
	1.9680	49.987			
			+.0001	+.003	
			-.0009	-.023	
Shaft ...	1.9689	50.010			
	1.9684	49.997			
Countershaft Front Bearing					
Housing Bore for Bearing ...	3.9377	100.017			
	3.9369	99.997			
			+.0013	+.033	
			-.0001	-.003	
Bearing Ext. Dia. ...	3.9370	100.000			
	3.9364	99.984			
Bearing Int. Dia. ...	2.1648	54.986			
	2.1654	55.002			
			+.0001	+.003	
			-.0011	-.028	
Shaft ...	2.1659	55.014			
	2.1653	54.998			
Countershaft Rear Bearing					
Housing Bore for Bearing ...	3.5440	90.018			
	3.5432	89.997			
			+.0013	+.033	
			-.0001	-.003	
Bearing Ext. Dia. ...	3.5433	90.000			
	3.5427	89.985			
Bearing Int. Dia. ...	1.9680	49.987			
	1.9685	50.000			
			+.0001	+.003	
			-.0009	-.023	

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Shaft	1.9689	50.010			
	1.9684	49.997			
Countershaft Forward Auxiliary Bearing (De Luxe Tractors Only)					
Bearing Bore in Housing ...	3.1500	80.010			
	3.1490	79.985			
			+.0009	+.023	
			-.0006	-.015	
Bearing Ext. Dia.	3.1496	80.000			
	3.1491	79.987			
Bearing Int. Dia.	1.5743	39.987			
	1.5748	40.000			
			+.0001	+.003	
			-.0008	-.020	
Shaft	1.5751	40.008			
	1.5747	39.997			
Clutch Pilot Bearing					
Recess in Flywheel for Clutch Pilot Bearing	1.573	39.954			
	1.574	39.980			
			-.0013	-.033	
			-.0008	-.020	
Pilot Bearing Ext. Dia. ...	1.5743	39.987			
	1.5748	40.000			
Pilot Bearing Int. Dia. ...	.6689	16.990			
	.6694	17.003			
			.0003	.007	
			.0012	.030	
Main Drive Shaft Pinion Spigot Dia. ... ..	.6686	16.982			
	.6682	16.972			
Main Drive Shaft Retainer					
Bore in Retainer for front and middle bearings (De Luxe Tractors only)	3.1503	80.018			
	3.1493	79.992			
			+.0012	+.030	
			-.0003	-.008	
Bearings Ext. Dia.	3.1496	80.000			
	3.1491	79.987			
Bearings Int. Dia.	1.9680	49.987			
	1.9685	50.000			
			+.0001	+.002	
			-.0009	-.023	
Dia. of P.T.O. Main Drive Shaft Pinion	1.9689	50.010			
	1.9684	49.997			
Bore in Retainer for Rear Bearing Assy. (Standard and De Luxe Tractors) ...	3.1503	80.018			
	3.1493	79.992			
			+.0012	+.030	
			-.0003	-.008	

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Bearing Ext. Dia.	3.1496	80.000			
	3.1491	79.987			
Bearing Int. Dia.	1.5743	39.987			
	1.5748	40.000			
			+.0001	+.003	
			-.0008	-.020	
Dia. of Main Drive Shaft	1.5751	40.008			
Pinion	1.5747	39.997			
Oil Seals					
Bore in Main Drive Shaft	2.251	57.175			
Retainer for Front Oil Seal	2.249	57.125			
(De Luxe Tractors) ...			-.011	-.279	
			-.005	-.127	
Oil Seal Ext. Dia.	2.260	57.404			
	2.256	57.302			
Oil Seal Int. Dia.	1.75	44.45			Mean Dia.
P.T.O. Main Drive Shaft	1.747	44.374			
Pinion	1.753	44.526			
Bore in Main Drive Shaft	2.251	57.175			
Retainer for Front Oil Seal	2.249	57.125			
(Standard Tractors) ...			-.011	-.279	
			-.001	-.0254	
Oil Seal Ext. Dia.	2.260	57.404			
	2.252	57.201			
Oil Seal Int. Dia.	1.125	28.575			Mean Dia.
P.T.O. Main Drive Shaft	1.128	28.651			
Pinion Dia.	1.122	28.499			
Bore in P.T.O. Main Drive	1.563	39.700			
Shaft Pinion for Oil Seal	1.561	39.649			
(De Luxe Tractors) ...			.000	.000	
			.012	.300	
Oil Seal Ext. Dia.	1.573	39.954			
	1.563	39.700			
Oil Seal Int. Dia.	1.125	28.575			Mean Dia.
Main Drive Shaft Pinion ...	1.128	28.651			
	1.122	28.499			
Epicyclic Assembly					
Bore in Epicyclic Carrier for	.748	18.999			
Planetary Pinion Shaft ...	.749	19.025			
			-.0018	-.046	
			-.0011	-.028	
Dia. of Shaft ... ..	.7501	19.053			
	.7498	19.045			
Dia. of Rollers ... ..	.1244	3.160			
	.1242	3.155			

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Dia. of Planetary Pinion	.990	25.146			
Washer ... ..	.984	24.993			
			.0158	.401	
			.0093	.236	
Planetary Pinion Int. Dia. ..	.9998	25.315			
	.9993	25.382			
Reverse Shaft Cluster					
Inside Dia. of Gears	1.2524	30.531			
	1.2530	30.556			
Dia. of Roller Bearings ...	.1260	3.200			
	.1258	3.195			
Dia. of Shaft	1.000	25.4			
	.9995	25.387			
Hydraulic Pump					
	Constant running, positive displacement four cylinder, scotch-ycke piston type pump "floating" in the tractor centre housing.				
Speed ... ..	.36 X engine speed. Oscillating control valve.				
Earlier Type (Fitted up to Tractor Serial No. 65684).					
Bore ... ..	.80" (20.32 mm.)				
Test Data	Minimum delivery to be 2.8 Imp. gallons (12.72 litres) per minute at zero/lb. sq. in. at 720 pump r.p.m. (2000 engine r.p.m.).				
Later Type (Fitted to Tractor Serial No. 65685 and subsequent).					
Bore ... ..	.915" (23.24 mm.)				
Test Data	Minimum delivery to be 3.333 Imp. gallons (15.14 litres) at 1500 p.s.i. (105.5 kg./sq. cm.) at 720 pump r.p.m. (2000 engine r.p.m.) with oil at a maximum viscosity of 250 S.U.S.				
Note : Approximate oil temperatures corresponding to a maximum viscosity of 250 S.U.S.					
	S.A.E. 80 — 130°F. (54.4°C.)				
	S.A.E. 40 — 135°F. (57.2°C.)				
	S.A.E. 50 — 150°F. (65.6°C.)				
Hydraulic System Safety Relief Valve					
Nominal Setting	2,500 lb. sq. in. (175.8 kg./sq. cm.)				
Test Data	The valve must begin to open at a minimum static pressure of 2300 lb/sq. in. (161.7 kg/sq.cm.) The maximum pressure must not exceed 2800 lb. sq. in. (196.9 kg./sq. cm.) when by- passing 2 Imp. gallons (9.1 litres) per minute. S.A.E. 50 oil at 110°-140°F. (43.3°-60°C.).				
Lifting Capacity—Lower Links					
	Early Tractors		Later Tractors		
	(Up to Serial No. 65684)		(Serial No. 65685 onwards)		
Max. Weight which can be lifted from the lowest position	1,500 lbs. (680.4 kg.)		2,500 lbs. (1134 kg.)		
Recommended Max. Weight for field work and slow speed transport ...	1,700 lbs. (771 kg.)		2,600 lbs. (1179.3 kg.)		
Recommended Max. Weight for road work in transport position	1,270 lbs. (576 kg.)		1,800 lbs. (816.5 kg.)		

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Hydraulic Tapping Points					
Three Pick-Up Points in lift cover—					
Thread Sizes—Top ... ..	...	...	...	...	...
Laterals ... ..	...	...	...	...	...
Oil Capacity					
(Supplying Hydraulic System, Transmission and Rear Axle)					
6.6 Imp. gallons (30.28 litres)					
Maximum of 1½ gallons (6.81 litres) may be withdrawn for operating external services.					
Hydraulic Lift Assembly					
Breakout Spring	Free Length	6 13/16" (173.038 mm.)			
	Solid Length	3 11/16" (93.663 mm.)			
	Rate:	To support 38 lbs. ± 2¼ lbs. (17.24 kg. ± 1.247 kg.) at a length of 4.75" (120.65 mm.)			
		To support 47½ lbs. ± 3½ lbs. (21.432 kg. ± 1.474 kg.) at a length of 4.25" (107.95 mm.)			
Control Spring	Free Length	5.38" (136.652 mm.)			
		5.32" (135.128 mm.)			
	Rate:	7,700 lb. in. ± 700 lb. in. (8,870 kg. cm. ± 807 kg. cm.)			
Hydraulic Cylinder					
Earlier Type (Fitted up to Tractor Serial No. 65684)					
Hydraulic Cylinder Bore	2.5010	63.525			
	2.4995	63.487	.0040	.1016	
			.0015	.038	
Hydraulic Cylinder Piston Dia.	2.497	63.4238			
	2.498	63.4492			
Piston Ring Groove Width ... ..	.1255	3.1877			
	.1265	3.2131	.0035	.089	
			.0015	.038	
Piston Ring Width ... ..	.124	3.1496			
	.123	3.1242			
Piston Ring Gap (closed) ... ..	.0025	.0635			
	.0075	.1905			
Later Type (Tractor Serial No. 65685 and subsequent)					
Hydraulic Cylinder Bore	2.9995	76.187			
	3.001	76.225	.0040	.1016	
			.0015	.038	
Hydraulic Cylinder Piston Dia.	2.998	76.149			
	2.997	76.124			
Piston Ring Groove Width...	.1255	3.188			
	.1265	3.213	.0035	.089	
			.0015	.038	
Piston Ring Width ... ..	.124	3.150			
	.1235	3.136			
Piston Ring Gap (closed) ... ..	.0075	.1905			
	.0025	.0635			

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Camshaft					
Bore for Bearing in Front and Rear Housings	1.6208 1.6198	41.168 41.143			
			— .0002 — .0017	— .005 — .043	
Bearing Outside Dia. ...	1.6215 1.6210	41.186 41.174			
Bearing Internal Dia. ...	1.3780 1.3775	35.001 34.988			
			.0035 .0025	.089 .064	
Shaft Dia.	1.3750 1.3745	34.925 34.912			
Control Valve					
Bore in Rear Housing for Control Valve Washers ...	.926 .924	23.520 23.470			
			.004 .001	.102 .025	
Outside Dia. of Control Valve Washers ... ..	.923 .922	23.444 23.419			
Internal Dia. of Control Valve Washers ... ..	.5002 .5000	12.705 12.700			
			.0006 .0002	.015 .005	Selectively assembled to a mean clearance of .0004" (.010 mm.)
Control Valve Dia. ... ..	.4998 .4996	12.695 12.690			
Cam Blocks and Pistons					
Piston (Inside Dia.)	2.322 2.325	58.979 59.055			
			.008 .002	.203 .051	
Cam Block	2.320 2.317	58.928 58.852			
Pistons and Valve Chambers					
Inlet and Outlet Valves					
Bore in Inlet Valve Stem ...	.157 .156	3.988 3.962			
			.003 .001	.076 .025	
Outlet Valve Stem ... ..	.155 .154	3.940 3.912			
Earlier Pumps (Up to Tractor Serial No. 65684)					
Diameter of Piston ... ..	.8010 .8005	20.345 20.333			
			.0025 .001	.064 .025	
Diameter of Bore ... ..	.802 .803	20.371 20.396			

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Later Pumps (Tractor Serial No. 65685 onwards)					
Diameter of Piston ... ..	.9130	23.19			
	.9125	23.18			
			.0025	.064	
			.001	.025	
Diameter of Bore ... ..	.914	23.22			
	.915	23.24			
Power Take-Off Shaft					
No. of Splines	6				
Major Diameter	1.371/1.373"	(34.82/34.87 mm.)			
Minor Diameter	1.098/1.108"	(27.89/28.14 mm.)			
Width of Splines ... ..	.338/.340"	(8.58/8.64 mm.)			
Length suitable for Drive Attachment	2.78"	(70.6 mm.)			
Diameter of hole	$\frac{3}{8}$ "	(8.33 mm.)			
Distance of hole from Shaft End ... ..	.625"	(15.88 mm.)			
Dimensions of Groove	Bottom dia.	1.160/1.155"	(29.46/29.34 mm.)		
	Radius	.265"	(6.73 mm.)		
Distance of Groove from Shaft End	1 $\frac{1}{8}$ "	(28.6 mm.)			
Width of Groove in P.T.O. Pinion (Ground speed P.T.O. driven gear) ... ..	.375	9.525			
	.379	9.626			
			.011	.279	
			.003	.076	
Dia. of P.T.O. Coupler at Pressure End ... ..	.372	9.449			
	.368	9.347			
Ground Speed P.T.O.	Backlash between ground P.T.O. driven gear and ground P.T.O. drive gear: .003/.007"				
	(0.076/.178 mm.).				
Rear Bearing and Seal					
Bore in centre housing for P.T.O. Seal Retainer	3.252	82.601			
	3.250	82.550			
			.007	.1778	
			.002	.0508	
P.T.O. Seal Retainer Outside Dia.	3.248	82.499			
	3.245	82.423			
P.T.O. Seal Retainer Inside Dia.	2.687	68.250			
	2.685	68.199			
			-.0075	-.1905	
			-.0025	-.0634	
P.T.O. Seal Outside Dia.	2.6925	68.390			
	2.6895	68.313			
Housing Bore for Bearing	2.9533	75.014			
	2.9527	74.999			
			+.001	+.025	
			-.0001	-.003	
Bearing—Outside Dia.	2.9528	75.001			
	2.9523	74.987			

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Single Clutch					
Diameter	Carburettor Engine Tractors ...		9" (228.6 mm.)		
	Diesel Engine Tractor (23C) ...		10" (254 mm.)		
	Diesel Engine Tractor (3-A-152)...		11" (279 mm.)		
Clutch Springs	9" Clutch		9 black clutch springs Fitted Load 150/160 lb. (68.04/72.57 kg.)		
	10" Clutch		12 green clutch springs Fitted Load 105/115 lb. (47.63/52.2 kg.)		
	11" Clutch		12 yellow clutch springs Fitted Load 84 lb. (38.1 kg.) ± 5%		
Clutch Pedal Free Movement	3/8" (19 mm.) This dimension taken between upper side of pedal and underside of footrest bracket.				
Toggle Release Levers ...	Height (from flywheel face)				
	9" Clutch		1.895" (48.133 mm.)		
	10" Clutch		1.995" (50.673 mm.)		
	11" Clutch		4 3/32" + .0625 (111.919 + 1.588 mm.) - .0000 (- .000 mm.)		
	Height (from spacer segments)				
	11" Clutch		2.65"-2.72" (67.310-69.088 mm.)		
Movement of Lever Ends ...	9" and 10" ... ..		.531" (13.49 mm.)		
	11" ... ..		.654" (16.61 mm.)		
	Variation in toggle lever height should not exceed .015" (.381 mm.)				
Dual Clutch					
87 mm. and 23C Engines					
Transmission Disc	11" dia. (279.4 mm.)				
P.T.O./Hydraulic Pump Disc	9" dia. (228.6 mm.)				
Thrust Springs	2, Belleville Type Load (see Fig. 5, page 1.4) at .075" (1.905 mm.) deflection 510/440 lb. (231.33/199.58 kg.) at .065" (1.651 mm.) deflection 1080/960 lb. (489.89/435.45 kg.)				
Clutch Pedal Free Movement	3/8" (9.5 mm.) This dimension taken between upper side of pedal and underside of footrest bracket.				
Toggle Release Levers ...	Height (from flywheel face) 3 11/32" (96 mm.) Movement of lever ends .531 (13.49 mm.) Variation in toggle lever height should not exceed .015" (.381 mm.)				
Adjusting Screws	Clearance between screw heads and rear pressure plate (P.T.O./Hydraulic pump drive) .088/.092" (2.24/2.34 mm.)				
3-A-152 Engine					
Transmission Disc	11" dia. (279.4 mm.)				
P.T.O./Hydraulic Pump Disc	9" dia. (228.6 mm.)				
Thrust Springs	11" disc operated by 12 yellow clutch springs. Fitted load 84 lb. (38.1 kg.) ± 5%. 9" disc operated by Belleville spring. Load—released position .75" (19.05 mm.) height: 510-440 lb. (231-200 kg.) Load—engaged position .065" (1.65 mm.) deflection 1080-960 lb. (490-435 kg.)				
Clutch Pedal Free Movement	3/8" (9.5 mm.) This dimension taken between upper side of pedal and underside of footrest bracket.				
Toggle Release Levers ...	Height (from flywheel face)		4 3/32" + .0625 (111.919 + 1.588 mm.) - .0000 (- .000 mm.)		
	Height (from spacer segments)		2.65-2.72" (67.310-69.088 mm.)		
	Movement of lever ends .654" (16.61 mm.). Variation in toggle lever height should not exceed .015" (.381 mm.)				

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Adjusting Screws					Clearance between screw heads and rear pressure plate (P.T.O./Hydraulic pump drive) .088/.092" (2.24/2.34 mm.)
Rear Axle					
Crown Wheel and Pinion Ratio					6.16 : 1
Backlash—Crown Wheel and Pinion ... ..					.008-.016" (.203-.406 mm.)
Clearance between thrust block and crown wheel					.013-.020" (.330-.508 mm.)
					Controlled by shims between thrust block and housing
Axle Shaft Bearing end float ... ..					.002-.008 (.051-.203 mm.)
					Controlled by shims between brake backplate and axle housing gaskets
Rear Axle					
Half Shafts and Axle Housings					
Half Shaft Dia.	2.252	57.200			
	2.251	57.175			
			—.000	—.000	
			—.002	—.051	
Inside Dia. of Bearing	2.251	57.175			
	2.250	57.150			
Outside Dia. of Bearing	4.126	104.800			
	4.125	104.775			
			—.0025	—.0635	
			—.0005	—.0127	
Bore for Bearing in Retainer	4.1245	104.762			
Assembly	4.1235	104.737			
Bore for Oil Seal in Retainer	3.6215	91.986			
Assembly	3.6245	92.062			
			—.0095	—.216	
			—.0015	—.038	
Outside Dia. of Oil Seal	3.630	92.202			
	3.626	92.100			
Half Shaft Dia. at Oil Seal	2.749	69.825			
	2.751	69.875			
Half Shaft Dia. for Collar	2.2515	57.188			
	2.2510	57.175			
			—.008	—.203	
			—.006	—.152	
Collar	2.2450	57.023			
	2.2435	56.985			
Recess in Axle Housing for	2.876	73.050			
Inner Oil Seal	2.874	73.000			
			—.007	—.1778	
			—.001	—.0254	
Outside Dia.—Inner Oil Seal	2.881	73.177			
	2.877	73.075			
Half Shaft Dia. at Inner Oil	2.128	54.051			
Seal	2.123	53.924			
Clearance between ends of axles	.002"-.008" (.051-.203 mm.)				
Differential					
Axle Housing Bores for Bear-	4.4365	112.687			
ing Assys.	4.4355	112.662			
			—.003	—.076	
			—.001	—.025	

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Bearing—Outside Dia. ...	4.4385	112.738			
	4.4375	112.713			
Bearing—Inside Dia. ...	2.6256	66.690			
	2.6250	66.675			
			— .0035	— .089	
			— .0014	— .036	
Differential Gear Case Dia. for Bearings ...	2.6285	66.764			
	2.6270	66.726			
Pinion Pilot Bearing					
Bore in Centre Housing ...	2.440	61.976			
	2.439	61.951			
			.0028	.071	
			.0006	.015	
Bearing—Outside Dia. ...	2.4384	61.925			
	2.4372	61.905			
Bearing—Inside Dia. ...	1.1811	30.000			
	1.1807	29.900			
			— .0012	— .031	
			— .0003	— .008	
Pinion Dia. ..	1.1819	30.020			
	1.1814	30.008			
Driving Pinion Sleeve and Bearing Assembly					
Sleeve—Inside Dia. ...	3.749	95.225			
	3.748	95.199			
			— .003	— .076	
			— .001	— .025	
Bearing Cup — Outside Dia.	3.751	95.275			
	3.750	95.250			
Bearing—Inside Dia. ...	1.7500	44.450			
	1.7506	44.465			
			— .0004	— .010	
			— .002	— .051	
Pinion Dias. for Bearings ...	1.751	44.475			
	1.752	44.501			
			.0005	.013	
			.0016	.041	
	1.7495	44.437			
	1.7490	44.425			
Front Axle					
Front Axle and Centre Pin Assembly					
(Up to Tractor Serial No. 4859)					
Centre Axle Bore for Bush ...	1.912	48.565			
	1.910	48.514			
			— .0055	— .140	
			— .002	— .051	
Centre Bush Ext. Dia. ...	1.9155	48.654			
	1.914	48.616			
Centre Bush Int. Dia. ...	1.7615	44.742			
	1.7675	44.895			
			.021	.533	
			.014	.356	
Pin Dia. ...	1.7480	44.399			
	1.7465	44.361			
Bores for Pin in Front Axle Support ...	1.748	44.399			
	1.750	44.450			

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
(Tractor Serial No. 4860)					
Centre Axle Bore for Bush...	2.058	52.273			
	2.057	52.248			
			-.0055	-.140	
			-.003	-.076	
Centre Bush Ext. Dia. ...	2.0625	52.388			
	2.0610	52.349			
Centre Bush Int. Dia. ...	1.7615	44.742			
	1.7675	44.894			
			.0135	.343	
			.021	.533	
Pin Dia. ...	1.7480	44.399			
	1.7465	44.361			
Bores for Pin in Front Axle Support ...	1.748	44.399			
	1.750	44.450			
Front Axle and Spindle Assemblies					
Bore of Outer Axle for	1.3745	34.912			Hand Press Fit
Spindle Bushes ...	1.3735	34.889			
Ext. Dia. Spindle Bushes ...	1.3745	34.912			
	1.3735	34.889			
Int. Dia. Spindle Bushes ...	1.250	31.750			
	1.249	31.725			Reamed in position
			.0035	.089	
			.005	.127	
Spindle Shaft Dia. ...	1.2455	31.636			
	1.2450	31.623			
Hub					
Bore for Oil Seal ...	2.685	68.199			
	2.683	68.148			
			-.009	-.229	
			-.005	-.127	
Oil Seal Outside Dia. ...	2.692	68.377			
	2.690	68.326			
Bore for Inner Bearing ...	2.4395	61.963			
	2.4405	61.989			
			-.0025	-.064	
			-.0005	-.013	
Inner Bearing—Outside Dia.	2.442	62.027			
	2.441	62.001			
Inner Bearing—Inside Dia. ...	1.2505	31.763			
	1.2500	31.750			
			-.001	-.025	
			-.000	-.000	
Shaft Dia. ...	1.2500	31.750			
	1.2495	31.737			
Bore for Outer Bearing ...	1.9365	49.187			
	1.9375	49.212			
			-.012	-.292	
			-.0005	-.013	
Outer Bearing—Outside Dia.	1.948	49.479			
	1.938	49.225			

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
	Outer Bearing—Inside Dia.	.7500 .7505	19.050 19.062	.000 .001		.000 .025
Shaft Dia. ... ..	.7500 .7495	19.050 19.037			

Steering

The permissible backlash between the worm spindle and the ball nut should not exceed $\frac{1}{2}$ " measured at the rim of the steering wheel.

The backlash between the two gears should be held to a maximum of .002" in the straight ahead position of the steering.

Inside Dia. Spherical Ball Ring	.8445 .8435	21.450 21.425	— .001 + .001	— .025 + .025	
Steering Column (Inner) Dia.	.8450 .8435	21.463 21.425	.061 .068	1.549 1.727	
Inside Dia. Spherical Ball Race	.906 .911	23.012 23.139			

Steering Box

Bore for bushes in Steering Box and Cover Plate ...	1.378 1.379	35.001 35.027			Press fit in housing
Outside Dia. of Bush ...	1.378 1.379	35.001 35.027			
Inside Dia. of Bush	1.2495 1.2485	31.737 31.711	.003 .001	.076 .025	Finished in position
Shaft	1.2475 1.2465	31.687 31.661			

Belt Pulley Attachment

Backlash between driving gears ... ..	.004"-.006" (.102-.152 mm.)				
Preload on Pinion Shaft ...	2 to 4 in. lb. (2.3-4.6 kg. cm.)				
Drive Pulley Housing Bore ...	2.4414 2.4408	62.012 61.996	+ .0011 — .0001	+ .028 — .003	
Outside Dia. Bearing ...	2.4409 2.4403	62.000 61.984			
Inside Dia. Bearing	1.1811 1.1807	29.997 29.990	+ .0001 — .0007	+ .003 — .018	
Pulley Drive Shaft	1.1814 1.1810	30.008 29.997			
Pulley Drive Gear Dia. ...	1.7500 1.7495	44.450 44.437			

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
	Needle Roller Bearing — Outside Dia.	2.1255 2.1245	53.988 53.962	+ .001 — .0005		+ .0254 — .0127
Input Bearing Housing—Bore for bearing and oil seal ...	2.1250 2.1245	53.975 53.962	— .002 — .0065	— .0508 — .1651	
Oil Seal—Outside Dia. ...	2.131 2.127	54.127 54.026			
Pulley Drive Housing Assy. Bore for Inner Bearing ...	2.8745 2.8735	73.012 72.987	— .0005 — .0025	— .0127 — .0635	
Inner Bearing—Outside Dia.	2.875 2.876	73.025 73.050			
Inner Bearing—Inside Dia.	1.3755 1.3750	34.938 34.925	— .0005 — .0015	— .0127 — .038	
Pulley Drive Pinion ...	1.3760 1.3765	34.950 34.963			
Pulley Drive Housing Assy. Bore for Outer Bearing ...	2.7165 2.7155	68.999 68.973	— .0005 — .0025	— .013 — .064	
Outer Bearing—Outside Dia.	2.7180 2.7170	69.037 69.012			
Outer Bearing—Inside Dia.	1.3756 1.3750	34.940 34.925	+ .0009 — .0002	+ .023 — .005	
Pulley Drive Pinion ...	1.3752 1.3747	34.930 34.917			
Pulley Drive Housing Assy. Recess for Oil Seal ...	2.751 2.749	69.875 69.825	— .0052 — .0028	— .132 — .071	
Oil Seal—Outside Dia. ...	2.7542 2.7538	69.957 69.946			

87 MM. PETROL ENGINE

No. of Cylinders	...	...	...	...	...	...	4
Bore	...	...	...	...	...	...	87 mm.
Stroke	...	...	...	...	...	...	92 mm.
Piston Displacement	...	...	...	...	...	...	2186.5 c.c. (133.4 cu. in.)
Compression Ratio	...	...	...	...	...	...	6.0 : 1 or 6.6 : 1
Firing Order	...	...	...	...	...	...	1, 3, 4, 2.
							6.0 : 1 Ratio
Brake H.P. (Bare Engine)	...	...	...	...	...	...	37.25
Belt H.P. (Bare Engine)	...	...	...	...	...	...	34.5
Equivalent Crankshaft Torque	...	...	...	...	...	...	99 lb. ft. at 1280 r.p.m.
							6.6 : 1 Ratio
							38.0
							36.2
							105.3 lb. ft. at 1200 r.p.m.

TIGHTENING TORQUES

				lbs./ft.		kg./m.	
Camshaft Locating Plate Attachment	...	...	...	18 — 20	...	2.489 — 2.765
Caps—Connecting Rod	...	...	...	50 — 55	...	6.913 — 7.604
Caps—Main Bearings	...	...	...	85 — 90	...	11.752 — 12.443
Clutch Attachment—Single	...	...	...	20	...	2.765
Clutch Attachment—Dual	...	...	...	22 — 24	...	3.042 — 3.318
Cover Plate to Rear Face of Combustion Head	...	...	...	18 — 20	...	2.489 — 2.765
Cylinder Head	...	...	...	60 — 65	...	8.295 — 8.987
Dynamo Bracket Assembly to Cylinder Block	...	...	...	18 — 20	...	2.489 — 2.765
Dynamo to Bracket	...	...	...	18 — 20	...	2.489 — 2.765
End plates, Timing Cover,	} 353 528 X1	...	...	12 — 14	...	1.659 — 1.936
Dynamo Bracket Attachments		354 614 X1	16 — 18	...	2.212 — 2.489
		354 616 X1	18 — 20	...	2.489 — 2.765
Fan and Pulley to Hub	...	...	...	18 — 20	...	2.489 — 2.765
Fan Pulley Hub to Water Pump Spindle	...	...	...	12 — 14	...	1.659 — 1.936
Filter to Sump	...	...	...	12 — 14	...	1.659 — 1.936
Flywheel Attachment to Crankshaft	...	...	...	42 — 46	...	5.807 — 6.360
Governor Attachment to Chainwheel	...	...	...	8 — 10	...	1.106 — 1.383
Link to Dynamo	...	...	...	18 — 20	...	2.489 — 2.765
Manifold Attachment	...	...	...	22 — 24	...	3.042 — 3.318
Oil Filter Attachment	...	...	...	22 — 24	...	3.042 — 3.318
Oil Filler Body to Block	...	...	...	18 — 20	...	2.489 — 2.765
Oil Pump Attachment	...	...	...	12 — 14	...	1.659 — 1.936
Rear Oil Seal Attachment etc.	...	...	...	8 — 10	...	1.106 — 1.383
Rocker Pedestal	...	...	...	22 — 24	...	3.042 — 3.318
Starter Motor Attachment	...	...	...	37 — 40	...	5.116 — 5.530
Sump Attachment	...	...	...	16 — 18	...	2.212 — 2.489
Timing Chain Wheel Attachment to Camshaft	...	...	...	22 — 24	...	3.042 — 3.318
Water Pump Bearing Housing to Body	...	...	...	22 — 24	...	3.042 — 3.318
Water Pump to Combustion Head	...	...	...	26 — 28	...	3.595 — 3.871

DIMENSIONS AND TOLERANCES

Component Details	Dimensions		Clearances		Remarks
	New		New		
	Ins.	mm.	Ins.	mm.	
Main Bearings					
Housing Bore	...	2.6255	66.688		For checking housing or bearing bores fit bearing cap and tighten to specified torque.
	...	2.625	66.675		
Radial Thickness of Bearings		.07225	1.835		
		.0720	1.829		

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Bearing Bore Dia. (fitted) ...	2.4815 2.4805	63.030 63.005	.0025 .0010	.064 .025	Similar tolerances for re-ground crankshaft to .010", .020", .030", (.254, .508, .762 mm.) undersize.
Crankshaft					
Journal Dia.	2.479 2.4795	62.967 62.979			
Crankshaft Fillet Radii ...	Standard Undersize	.085" (2.16 mm.) .095" (2.41 mm.)			
Crankshaft End Float					
Centre Journal Length ...	1.7507 1.7498	44.468 44.445	.0117 .0048	.297 .122	
Centre Bearing Cap Width ...	1.559 1.557	39.599 39.548			
Thrust Washer Thickness (2 off) ... ..	.093 .091	2.362 2.311			Thrust washers also available .005" (.127 mm.) oversize.
Big End					
Crankpin Dia.	2.0866 2.0861	53.000 52.987	.0024 .0006	.061 .015	Similar tolerances for re-ground crankshaft to .010", .020", .030", .040", (.254, .508, .762, 1.016 mm.) undersize.
Bearing Bore Dia. (fitted) ...	2.0885 2.0872	53.048 53.015			For checking big-ends or bearing bores assemble connecting rod and tighten to specified setting.
Connecting Rod Bore Dia. ...	2.2335 2.2327	56.731 56.710			
Radial Thickness of Bearings	.0727 .0725	1.846 1.841			
Connecting Rod End Float					
Crankpin Length	1.1915 1.1865	30.264 30.137	.014 .007	.356 .178	
Connecting Rod Width ...	1.1795 1.1775	29.959 29.909			
Small End					
Bore for Bush	1.0000 .9995	25.400 25.387	-.0035 -.0050	-.09 -.13	Heat piston in boiling oil for removal and fitting of gudgeon pin
Bush External Dia.	1.0045 1.0035	25.514 25.489			
Bush Internal Dia. ... ..	.8752 .8748	22.230 22.220			
Gudgeon Pin Dia. ... ..	.8751 .8748	22.228 22.220	*+.00035 -.00030	+.009 -.008	*Specified clearances using drawing sizes but desired fit of gudgeon pin obtained by selective assembly
			*+.00045 -.00005	+.011 -.001	

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Gudgeon Pin Holes in Piston	.8753 .8750	22.233 22.226			
Pistons and Sleeves					
Piston Diameter (Thrust side top skirt)					
F. Grade	3.4213 3.4209	86.901 86.891			Oversize pistons +.020" (.508 mm.) available
G. Grade	3.4217 3.4213	86.911 86.901			
H. Grade	3.4221 3.4217	86.921 86.911			
			.0042 .0035	.107 .089	
Sleeve Bore (parallel)					
F. Grade	3.4251 3.4248	86.998 86.990			
G. Grade	3.4255 3.4252	87.008 87.000			
H. Grade	3.4259 3.4256	87.018 87.010			
Clearance, Bottom of Piston Skirt (thrust side) ...			.0027 .0020	.069 .051	Thrust side piston skirt tapered .0015" (.038 mm.) on dia.
Top Land Dia.	3.408 3.404	86.56 86.46			
Ring Groove Width Top and 2nd ... ..	.081 .080	2.057 2.032			Note: 2 Compression and 2 oil control rings per piston, oil control rings one above and one below gudgeon pin
Compression Ring Width ...	.0787 .0777	1.999 1.974	.0023 .0013	.058 .033	
Ring Groove Width 3rd and 4th ... ..	.190 .189	4.826 4.801			Similar tolerances for oversize rings +.010" (.254 mm.), +.200" (.508 mm.), +.030" (.762 mm.), +.040" (1.016 mm.).
Slotted Scraper Ring Width 3rd and 4th ... ..	.1875 .1865	4.763 4.737	.0035 .0015	.089 .038	
Ring Gap (closed) ... ..			.015 .010	.381 .254	
Clearance between Top Flange of Sleeve and Upper Block:					
Upper Block Dia.	4.140 4.125	105.156 104.775	.045 .015	1.143 .381	
Top Flange of Sleeve Dia. ...	4.110 4.095	104.394 104.013			
Clearance between Sleeve Spigot and Lower Block:					
Lower Block Dia.	3.6570 3.6555	92.887 92.849			
			.003 0005	.0762 .0127	
Sleeve Spigot Dia.	3.655 3.654	92.837 92.812			
Cylinder Block (Top face to seating face for sleeve ...	4.501 4.499	114.325 114.274			

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Gasket thickness (uncompressed) ... ..	.021	.533			
	.019	.483			
Cylinder Sleeve (Top face to seating face)	4.488	113.995			
	4.487	113.970			
Stand out of sleeve above cylinder block (Liner gasket uncompressed) ... ..			.010	.254	
			.005	.127	
Water Pump					
Housing Bore for Bearings ...	1.5749	40.002			
	1.5744	39.990			
			+.0006	+.015	
			-.0004	-.010	
Bearing Case Ext. Dia. ...	1.5748	40.000			
	1.5742	39.987			
Spindle Dia. ... ..	.6264	15.911			
	.6256	15.890			
			-.0034	-.086	
			-.0021	-.053	
Impellor Bore Dia. ... ..	.6235	15.837			
	.6230	15.824			
Thermostat					
Makers No. X 43570/19 (Fitted up to Engine No. SF16861EL)					
Valve begins to open ...		60°C. (140°F.)			
Valve fully open		65°C. (150°F.)			
Valve lift ... ..	.375"	9.5 mm.			
Makers No. 85035/60 (Fitted Engine No. SF16862EL onwards)					
Valve begins to open ...		58°C.-63°C. (136°F.-145°F.)			
Valve fully open		67°C. (152°F.)			
Valve lift ... ..	.312"	7.94 mm.			
Makers No. 85035/78 (Fitted Engine No. SF19919EH onwards)					
Fitted to 6.6 : 1 ratio engines only					
Valve begins to open ...		76°C.-81°C. (169°F.-178°F.)			
Valve fully open		95°C. (203°F.)			
Valve lift ... ..	.312"	7.94 mm.			
Oil Pump					
Approx. capacity of pump at 50 lb. sq. in. (3.515 kg. sq. cm.) using SAE 10 oil at 150°F: 3.95 galls (17.957 litres) per min., at 2000 r.p.m. oil pump. (Oil pump runs at half engine speed).					
Oil Pressure		25-60 lb. sq. in. (1.758-4.218 kg. sq. cm.)			
Outer Rotor, Outside Dia. ...	1.5975	40.577			
	1.5965	40.551			
			.008	.203	
			.006	.152	
Housing, Int. Dia.	1.604	40.741			
	1.603	40.716			
Bore, Inner Rotor ... ..	.4987	12.667			
	.4993	12.682			
			.0013	.033	
			.0002	.005	

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Pump Shaft Dia. ... ..	.4985	12.661			
	.4980	12.649			
Housing Bore Int. Dia. ...	.501	12.725	.003	.076	
	.4995	12.687	.001	.025	
Rotor Depth — Inner and Outer	.9990	25.375			
	.9985	25.362			
Housing Depth	1.001	25.425	.001	.025	A combined worn clearance of .005" (.127 mm.) indicates need of cover and housing face lapping.
	1.000	25.400	.0025	.064	
Inner Rotor, Major Dia. ...	1.172	29.769			
	1.171	29.743			
Inner Rotor, Minor Dia. ...	.731	18.567			
	.729	18.517			
Clearance on Rotors ...			.004	.102	Measured when major dia. of inner rotor and minor dia. of outer rotor are in line; when this clear- ance exceeds .010" (.254 mm.) new parts should be fitted.
			.0005	.012	
Camshaft					
Bore in Block for Front Journal	2.1913	55.659			
	2.1905	55.639			
Radial thickness of Bearings	.1303	3.310			
	.1285	3.264			
Bearing Bore Dia. (fitted) ...	2.0623	52.372			
	2.0605	52.337			
Front Journal Dia.	2.0595	52.311	.001	.025	
	2.0590	52.298	.0033	.084	
Bore in block for centre, intermediate and rear journals	1.8445	46.850			
	1.8435	46.825			
Radial thickness of Bearings	.1279	3.249			
	.1247	3.167			
Bearing Bore Dia. (fitted) ...	1.7188	43.659			
	1.7167	43.605			
Journal Dia. (Centre, Inter- mediate and Rear) ...	1.7157	43.580	.001	.025	
	1.7152	43.567	.004	.102	
Camshaft End Float					
Locating Groove ... ..	.1876	4.765			
	.1874	4.760			
Locating Plate ... ..	.1835	4.661	.0056	.142	
	.1820	4.623	.0039	.099	

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Tappets and Valves					
Tappet Bore in Block ...	.9380	23.825			
	.9373	23.807			
			.0013	.033	
			.0002	.005	
Tappet Dia. ...	.9371	23.802			
	.9367	23.792			
Valve Tip Clearances (Cold)					
Inlet... ...	.012	.305			
Exhaust ...	.008	.203			
Inlet Valve Stem Dia. ...	.311	7.900			
	.310	7.874			
			.003	.076	
			.001	.025	
Inlet Valve Guide Bore Dia. ...	.3130	7.950			
	.3120	7.925			
Exhaust Valve Stem Dia. ...	.3732	9.479			
	.3727	9.467			
			.003	.076	
			.0013	.033	
Exhaust Valve Guide Bore Dia.	.3755	9.538			
	.3745	9.512			
Valve Head Dia.					
Inlet ...	1.331	33.807			
	1.327	33.705			
Exhaust ...	1.238	31.445			
	1.234	31.344			
Guide projection above spring seat ...					
Valve lift ...	.59	14.986			
Valve Seating Angle on valve head ...	45°				
Valve Seat Angle in new cylinder head ...	44½°	but serviced at 45°.			
Inlet and Exhaust Valve Seat Inserts available for service purposes.					
Valve Springs					
Free Length ...	1.787	45.390	Fitted load	...38 lb. +2 lb. -1 lb. (17.237 kg. +.91 kg. -.45 kg.)	
Fitted Length ...	1.321	33.554	Full lift load	... 60 lb. (27.216 kg.)	
Valve Timing (Crankshaft Degrees)					
Exhaust Opens ...	40°	before B.D.C.			
Exhaust Closes ...	T.D.C.				
Inlet Opens ...	T.D.C.				
Inlet Closes ...	40°	after B.D.C.			
Timing holes in flywheel and crankcase when aligned with tommy bar locate No. 1 and No. 4 T.D.C.					
Flywheel					
Spigot Dia. (for Starter Gear Ring) ...	13.406	340.512			
	13.403	340.436			
			.031	.7874	
			.023	.5842	

87mm Petrol Engine

B.2

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Starter Gear Ring (Inside Dia.)	13.380	339.852			
	13.375	339.725			
Crankshaft Spigot Dia. ...	4.0002	101.605			
	3.9995	101.587			
Flywheel Dia. for Spigot ...	4.0007	101.618	+ .0012	+ .031	
	3.9998	101.595	- .0004	- .010	

Run out of clutch contact face at outer diameter should not exceed .003" (.076 mm.)

Carburettor—Zenith Type 28G

Adjustments—Main Jet $1\frac{1}{4} \pm \frac{1}{8}$ turns
S.R. Jet $1\frac{1}{2}$ turns

One of the following:—

C. 1542

Identification Stamped C-1542. Dab of yellow paint on F.C. cover
Data: Choke Tube Dia. 19 mm.
Main Jet 245 c.c.
Air Jet70 mm.
S.R. Jet 70
Needle Seating 2.0 mm.
Fuel Level 17 mm. at 18" head
(measured from top face of carburettor bowl).

C. 1575

Identification Stamped C-1575. Dab of blue paint on F.C. cover, dab of green on bowl.
Data: Choke Tube Dia. 19 mm.
Main Jet 245 c.c.
Air Jet70 mm.
S.R. Jet 55
Needle Seating 2.0 mm.
Fuel Level 17 mm. at 18" head.
(measured from top face of carburettor bowl).

C. 1608

Identification Stamped C-1608. Dab of white paint on F.C. cover, dab of brown on bowl.
Data: Choke Tube Dia. 19 mm.
Main Jet 245 c.c.
Air Jet70 mm.
S.R. Jet 70
Needle Seating 2.0 mm.
Fuel Level 17 mm. at 18" head.
(measured from top face of carburettor bowl).

Battery 12 volt. 1 off. Ampere Hour Capacity
GTW 7A, GT 7A, GTZ 7A at 10 hour rate 38 amp. hour
BTW 7A, BT 7A, BTZ 7A at 20 hour rate 43 amp. hour
fully charged at 60°F. (16°C.)

Distributor D3A4 V160
Static Setting Up to Engine Serial No. SF 3818 E—1° B.T.D.C.
Engine Serial No. SF 3519 E onwards—5° B.T.D.C.

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Spark Plug		Champion L.10.		Lodge CN	
Thread Dia.		14 mm.		14 mm.	
Reach ... ..		.5" (12.7 mm.)		.5" (12.7 mm.)	
Gap ... ..		.030"-.032" (.76-.81 mm.)		.025"-.028" (.635-.710 mm.)	
Starter Motor		M 35 G			
No. of teeth flywheel gear ring and starter pinion		145 and 10 respectively.			
Distance of front mounting flange to rear face of flywheel gear ring ...		1.563" (39.7 mm.)			
Dynamo		C 39 P2		Runs at 1.9 x engine speed.	
Governor					
Range		400 - 2000 r.p.m. Engine			
Governor Lever Spring					
Free length (inside hooks) ...		3.80" (96.52 mm.)			
Rate		18 lb. in. (20.74 kg. cm.) +5%			
No. of coils		26			
Load at 1" (25.4 mm.) deflection		25 lb. ± 1lb. (11.34 kg. ±.454 kg.)			
Initial wound-in load		7 lb. (3.175 kg.)			
Governor Compensator Spring					
Free length (inside hooks) ...		3.125" (79.375 mm.)			
Rate		64 lb. in. (73.74 kg. cm.) ±5%			
No. of Coils		11½			
Load at ½" (12.7 mm.) deflection		38 lb. ±1½ lb. (17.24 kg. ±.681 kg.)			
Initial wound-in load		6 lb. (2.722 kg.)			

87 MM. V.O. ENGINE

No. of Cylinders	...	...	...	4
Bore	...	...	...	87 mm.
Stroke	...	...	...	92 mm.
Piston Displacement	...	...	...	2186.5 c.c. (133.4 cu. in.)
Compression Ratio	...	...	...	5.0 : 1
Firing Order	...	...	...	1, 3, 4, 2.
Brake H.P. (Bare Engine)	...	...	...	30.5
Belt H.P. (Bare Engine)	...	...	...	28.8
Equivalent Crankshaft Torque	...	...	...	84.0 lb. ft. at 1150 r.p.m.

DIMENSIONS AND TOLERANCES

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Pistons and Sleeves					
Piston Dia. (Thrust side top skirt)					
F. Grade	...	...			Oversize pistons \pm .020" (.508 mm.) available
	3.4213	86.901			
	3.4209	86.891			
G. Grade	...	...	
	3.4217	86.911			
	3.4213	86.901			
H. Grade	...	...	
	3.4221	86.921			
	3.4217	86.911			
			.0042	.107	
			.0035	.089	
Sleeve Bore (Parallel)					
F. Grade	...	...	
	3.4251	86.998			
	3.4248	86.990			
G. Grade	...	...	
	3.4255	87.008			
	3.4252	87.000			
H. Grade	...	...	
	3.4259	87.018			
	3.4256	87.010			
Clearance—Bottom of Piston Skirt (Thrust side)			.0027	.069	Thrust side piston skirt tapered .0015" (.038 mm.) on diameter.
			.0020	.051	
Top Land Dia.	...	...	
	3.408	86.563			
	3.404	86.462			
Ring Groove Width Top and 2nd	...	...			Note: Three compression and two oil control rings per piston. Oil control rings located one above and one below gudgeon pin.
	.083	2.108			
	.082	2.083			
			.005	.1270	
			.003	.0762	
Compression Ring Width	...	...	
	.0787	1.999			
	.0777	1.974			
			.004	.1016	
			.002	.0508	
Ring Groove Width, 3rd	...	...	
	.082	2.083			
	.081	2.060			

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Ring Groove Width, 4th and 5th ... ..	.1905	4.839			
	.1895	4.813			
			.004	.102	
			.002	.051	
Slotted Scraper Ring Width	.1875	4.763			
	.1865	4.737			
Ring Gap (closed) ... ..			.015	.381	
			.010	.254	

Thermostat

Makers No. X 43570/25 (Fitted up to Engine Serial No. SG 5983 E)

Valve begins to open 75°C.-80°C. (167°F.-176°F.)

Valve fully open 95°C. (203°F.)

Valve lift312" (7.93 mm.)

Makers No. 85035/78 (Fitted Engine Serial No. SG 5984 E onwards)

Valve begins to open 76°C.-81°C. (169°F.-178°F.)

Valve fully open 95°C. (203°F.)

Valve lift312" (7.93 mm.)

Carburettor Zenith Type 28G.Adjustments: Main Jet 2 $\frac{1}{4}$ turns
S.R. Jet 1 $\frac{3}{4}$ turns

One of the following:

C.1575

Identification Stamped C-1575. Dab of blue paint on F.C. cover, dab of green on bowl.

Data: Choke Tube Dia. 19 mm.

Main Jet 245 c.c.

Air Jet70 mm.

S.R. Jet 55

Needle Seating 2.0 mm.

Fuel Level 17 mm. at 18" head

(measured from top face of carburettor bowl)

C.1578

Identification Stamped C-1578. Dab of brown paint on F.C. cover, and on bowl.

Data: Choke Tube Dia. 19 mm.

Main Jet 245 c.c.

Air Jet70 mm.

S.R. Jet 80

Needle Seating 2.0 mm.

Fuel Level 17 mm. at 18" head.

(measured from top face of carburettor bowl)

Sparking Plug Champion N7 or N21

Thread Dia. 14 mm.

Reach $\frac{3}{8}$ "

Gap028"-.032" (0.71-0.81 mm.)

Lodge BL 14

14 mm.

 $\frac{3}{8}$ "

.025"-.028" (.635-.711 mm.)

For other details and data—Refer to 87 mm. bore petrol engine. Pages B19 to B26.

87 MM. LAMP OIL ENGINE

No. of Cylinders	...	...	...	4
Bore	...	...	...	87 mm.
Stroke	...	...	...	92 mm.
Displacement	...	...	...	2186.5 c.c. (133.4 cu. in.)
Compression Ratio	...	...	...	4.3 : 1
Firing Order	...	...	...	1, 3, 4, 2
Brake H.P. (Bare Engine)	...	...	...	29.0
Belt H.P. (Bare Engine)	...	...	...	26.3
Equivalent Crankshaft Torque	...	...	...	76.5 lb. ft. at 1200 r.p.m.

Thermostat

Makers No. X 43570/25 (Fitted up to Engine Serial No. SH 406 E)

Makers No. 85035/78 (Fitted Engine Serial No. SH 407 E onwards)

Carburettor	...	...	...	Zenith Type 28G.	Adjustments:	Main Jet $2\frac{1}{2} \pm \frac{1}{4}$ turns
						S.R. Jet $1\frac{1}{2}$ turns

For other details and data—Refer to 87 mm. V.O. engine. Pages B27 to B28.

23C DIESEL ENGINE

No. of Cylinders	...	...	...	4
Bore	...	...	...	$3\frac{5}{16}$ " (84.137 mm.)
Stroke	...	...	...	4" (101.6 mm.)
Displacement	...	...	...	137.89 cu ins.(2259 c.c.)
Compression Ratio	...	...	...	20 : 1
Firing Order	...	...	...	1, 3, 4, 2.
Brake H.P. (Bare Engine)	...	...	...	37.25
Belt H.P. (Bare Engine)	...	...	...	35.9
Equivalent Crankshaft Torque	...	...	...	100 lb. ft. at 1600 r.p.m.

TIGHTENING TORQUES

				lbs./ft.		kg.m.
Bearing Housing to Block—Centre	...	...	...	39 — 42	...	5.392 — 5.807
Bearing Housing to Block—Front	...	...	...	18 — 20	...	2.489 — 2.765
Bearing Housing—Upper to Lower	...	...	...	25 — 30	...	3.456 — 4.148
Bearing Housing (Rear) and Cover Attachment	...	...	...	18 — 20	...	2.489 — 2.765
Camshaft Chain Wheel to Centre	...	...	...	18 — 20	...	2.489 — 2.765
Clutch Attachment—Single	...	...	...	26 — 28	...	3.595 — 3.871
Clutch Attachment—Dual	...	...	...	22 — 24	...	3.042 — 3.318
Connecting Rod Bolts	...	...	...	65 — 70	...	8.987 — 9.678
Cylinder Head—Manifolds	...	...	...	22 — 24	...	3.042 — 3.318
Injectors	...	...	...	12 — 14	...	1.659 — 1.936
Rocker Shaft Oil Feed	...	...	...	16 — 18	...	2.212 — 2.489
Cylinder Head Attachment to Block	...	...	...	100 — 105	...	13.830 — 14.521
Dynamo Bracket to Cylinder Block	...	...	...	18 — 20	...	2.489 — 2.765
Dynamo Mounting	...	...	...	26 — 28	...	3.595 — 3.871

TIGHTENING TORQUES

Dynamo to Bracket	...	...	...	...	18 — 20	...	...	2.489 — 2.765
Exhaust Pipe Attachment	...	...	...	...	22 — 24	...	...	3.042 — 3.318
Fan Hub to Water Pump Spindle—Nyloc Nut	...	...	...	...	16 — 18	...	...	2.212 — 2.489
	...	...	...	...	—$\frac{5}{16}$ " UNF Nut	...	...	1.659 — 1.936
Fan Pulley to Hub	...	...	...	...	18 — 20	...	...	2.489 — 2.765
Flywheel Attachment	...	...	...	...	90 — 100	...	...	12.443 — 13.830
Fuel Pump Attachment	...	...	...	...	12 — 14	...	...	1.659 — 1.936
Injector Pump Drive Casing to Block—Setscrew	...	...	...	...	18 — 20	...	...	2.489 — 2.765
	...	...	...	...	—Bolt	...	...	2.212 — 2.489
Injection Pump Mounting	...	...	...	...	22 — 24	...	...	3.042 — 3.318
Injector Clamp	...	...	...	...	18 — 20	...	...	2.489 — 2.765
Oil Filter to Cylinder Block	...	...	...	...	26 — 28	...	...	3.595 — 3.871
Oil Pump Attachment	...	...	...	...	16 — 18	...	...	2.212 — 2.489
Oil Pump to Front Bearing Housing	...	...	...	...	12 — 14	...	...	1.659 — 1.936
Oil Suction Pipe Bracket to Cylinder Block	...	...	...	...	18 — 20	...	...	2.489 — 2.765
Oil Sump Attachment—Bolts and Setscrews	...	...	...	...	16 — 18	...	...	2.212 — 2.489
	...	...	...	...	—Nut	...	...	1.936 — 2.212
Rocker Cover and Pedestal	...	...	...	...	3 — 5	...	...	.415 — .691
Rocker Pedestal	...	...	...	...	22 — 24	...	...	3.042 — 3.318
Rocker Shaft to Pedestal	...	...	...	...	8 — 10	...	...	1.106 — 1.383
Starter Motor Attachment to Cylinder Block	...	...	...	...	37 — 40	...	...	5.116 — 5.530
Tappet Cover Attachment	...	...	...	...	18 — 20	...	...	2.489 — 2.765
Thermostat—Elbow to Thermostat Body and Body to Cylinder Head	...	...	...	...	18 — 20	...	...	2.489 — 2.765
Timing Cover	...	...	...	...	18 — 20	...	...	2.489 — 2.765
Timing Chain Tensioner Attachment	...	...	...	...	8 — 10	...	...	1.106 — 1.383
Water Pump Attachment	...	...	...	...	22 — 24	...	...	3.042 — 3.318
Water Pump Attachment to Cylinder Block	...	...	...	...	26 — 28	...	...	3.595 — 3.871

DIMENSIONS AND TOLERANCES

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Main Bearing Housings					
Front					
Housing Spigot Ext. Dia.	5.0615	128.562			Crankshaft bearings are available in the following undersizes: .010" (.254 mm.), .020" (.508 mm.), .030" (.762 mm.), .040" (1.016 mm.),
	5.0605	128.537	.0030	.076	
			.0005	.013	
Bore in Cylinder Block	5.0635	128.613			
	5.0620	128.575			
Centre					
Housing Spigot Ext. Dia.	6.8115	173.012			
	6.8105	172.987	.0035	.089	
			.0005	.013	
Bore in Cylinder Block	6.8140	173.076			
	6.8120	173.025			
Rear					
Housing Spigot Ext. Dia.	6.8740	174.600			
	6.8730	174.574	.0035	.089	
			.0006	.015	
Bore in Cylinder Block	6.8765	174.663			
	6.8746	174.613			

Main Bearings

Housing Bores: Front Centre	2.9195	74.155			For checking bore dia. assemble both halves with ring dowels fitted and screws tightened to 29-31 lbs. ft. (3.5-4.1 Kg.m.)
and Rear	2.9190	74.143			
Radial thickness of Bearings (Front, Centre and Rear) ...	.08250	2.096			With bearing fitted in housing, tighten to specified torque setting.
Bearing Bore Dia. (Front, Centre and Rear)	2.755	69.977			
	2.754	69.951			Desired clearance when assembled
Crankshaft Clearance ...			.0035	.089	
			.0020	.051	

Crankshaft

Journal Dias.	2.7520	69.901			Similar tolerances for re-ground crankshaft to .010" .020", .030", .040" (.254, .508, .762, 1.016 mm.) undersize.
	2.7515	69.888			

Crankshaft Fillet Radii

(Up to Engine No. SJ 114020E, Engine Nos. SJ 110521E to SJ 110538E, and Engine Nos. SJ 111386 to SJ 111413E).

Crankpins185/.175	4.70/4.45			These radii must be maintained if crankshaft is re-ground.
Journals—Front/Rear ...	.110/.100	2.79/2.54		
Centre ... ..	.150/.160	3.81/4.06		

(Engine Nos. SJ 110421E to SJ 110520E, Engine Nos. SJ 110539E to SJ 111385E, and Engine No. SJ 111414E and future).

Crankpins185/.175"	4.70/4.45			These radii must be maintained if crankshaft is re-ground.
Journals—Rear ... ..	.110/.100	2.79/2.54		
Front/Centre ... ..	.160/.150	4.06/3.81		

Crankshaft End Float

Rear Journal Length ...	1.7507	44.468			Big end bearings are available in the following undersizes: .010" (.254 mm.), .020" (.504 mm.), .030" (.762 mm.), .040" (1.016 mm.)
	1.7498	44.445	.0117	.297	
			.0048	.122	
Rear Bearing Housing Width	1.559	39.599			.005" (.127 mm.) oversize thrust washer available.
	1.557	39.548			
Thrust Washer Thickness ...	.093	2.362			
	.091	2.311			

Big End

Crankpin Dia.	2.3115	58.712			Similar tolerances for re-ground crankshaft to .010", .020", .030", .040", (.254, .508, .762, 1.016 mm.) undersize.
	2.3110	58.699	.0035	.089	
			.0020	.051	
Bearing Bore Dia.	2.3145	58.788			For checking bearing bores—assemble con. rod and tighten to specified setting.
	2.2135	58.763			
Con. Rod Bore Dia.	2.4575	62.421			
	2.4570	62.408			
Radial thickness of Bearings	.07175	1.822			
	.07150	1.816			

Component Details	Dimensions New		Clearances New		Remarks	
	Ins.	mm.	Ins.	mm.		
Connecting Rod End Float						
Crankpin Length	1.4390	36.551			Ovality or wear of any crankshaft journal must not exceed .002" (.050 mm.)	
	1.4370	36.500				
Width of Connecting Rod ...	1.429	36.296	.012	.305		
	1.427	36.245	.008	.203		
Small End						
Bore for Bush	1.251	31.775				*Specified clearance using drawing sizes but bore of bush machined to suit gudgeon pin for the required fit.
	1.250	31.750				
Bush External Dia.	1.255	31.877	-.005	-.127		
	1.2535	31.838	-.002	-.064		
Bush Internal Dia.	1.1248	28.570				
	1.1252	28.580	*+.0003	+.008		
Gudgeon Pin Dia.	1.12515	28.579	-.0003	-.008		
	1.12485	28.571				
Gudgeon Pin Holes in Piston	1.12515	28.579	†+.0003	+.008		
	1.12465	28.566	-.0005	-.013		
Pistons, Sleeves and Inserts						
Cylinder Liners						
Sleeve Bore (Parallel):						
F. Grade	3.3135	84.163			†Specified clearance using drawing sizes but desired fit of Gudgeon Pin in Piston obtained by selective assembly. Heat Piston in hot oil for fitting.	
	3.3130	84.150				
G. Grade	3.3140	84.176				
	3.3135	84.163				
H. Grade	3.3145	84.188				
	3.3140	84.176				
Clearance between top flange of sleeve and upper block:						
Upper Block — recess for	3.718	94.437				
Flange Dia.	3.716	94.386				
Top Flange of Sleeve Dia. ...	3.712	94.285	.008	.2032		
	3.710	94.234	.004	.1016		
Clearance between sleeve spigot and lower blocks:						
Lower Block Dia.	3.5343	89.771				
	3.5338	89.759				
Sleeve Spigot Dia.	3.5330	89.738	.0021	.053		
	3.5322	89.718	.0008	.020		
Thickness of Flange440	11.176				
	.439	11.151				

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Depth of Bore in Cylinder Block438	11.125			
	.436	11.074			
Stand out of liner above Cylinder Block004 .001	.102 .025	
Pistons (Automotive Engineering)					Alternative to Wellworthy Pistons and Sleeves graded F, G, and H. Replacement pistons and sleeves available as standard size only (i.e., no provision made for re-boring and fitting oversizes).
Piston Skirt Dia. Top (Oval Ground Tapered Skirt)					
F. Grade	3.3075	84.010			
	3.3071	84.000			
G. Grade	3.3080	84.023			
	3.3076	84.013			
H. Grade	3.3085	84.036			
	3.3081	84.026			
Piston/Sleeve Clearance— Top of Skirt Thrust Side ...			.0064 .0055	.163 .140
Piston Skirt Dia. (at Grading Position)					
F. Grade	3.3095	84.061			
	3.3091	84.051			
G. Grade	3.3100	84.074			
	3.3096	84.064			
H. Grade	3.3105	84.087			
	3.3101	84.077			
Piston/Sleeve Clearance (at Grading Position) ... ..			.0044 .0035	.112 .089
Piston/Sleeve Clearance Bottom of Skirt—Thrust Side ... ..			.0044 .0035	.112 .089
Ovality—Top of Skirt ...	.011	.279		
	.009	.230			
Ovality—Bottom of Skirt ...	.019	.483		
	.016	.406			
Pistons (Wellworthy)					Alternative to Automotive Engineering Pistons and Sleeves graded F, G and H. Replacement pistons and sleeves available as standard size only, (i.e. no provision made for reboring and fitting oversizes).
Piston Skirt Dia. Top (Oval Ground Tapered Skirt)					
F. Grade	3.3075	84.010			
	3.3071	84.000			
G. Grade	3.3080	84.023			
	3.3076	84.013			
H. Grade	3.3085	84.036			
	3.3081	84.026			
Piston/Sleeve Clearance (at Grading Position) ...			.0064 .0055	.163 .140
Piston Skirt Dia. Max.					
F. Grade	3.3085	84.036			
	3.3081	84.026			
G. Grade	3.3090	84.049			
	3.3086	84.038			
H. Grade	3.3095	84.061			
	3.3091	84.051			

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Piston Skirt Dia. (Bottom)					
F. Grade	3.3082	84.028			
	3.3078	84.018			
G. Grade	3.3087	84.041			
	3.3083	84.031			
H. Grade	3.3092	84.053			
	3.3088	84.043			
Clearance—Bottom of Piston			.0057	.145	
Skirt—Thrust Side ...			.0048	.122	
Ovality—Top of Skirt ...	.018	.457			
	.019	.482			
Ovality—Bottom of Skirt ...	.0095	.241			
	.0105	.266			
Piston Rings	Three compression rings and one Duaflex oil control ring.				
	The top compression ring is a chromium plated parallel type and may be fitted either way up, the 2nd and 3rd compression rings have a taper face and are not chromium plated. To facilitate assembly the word "TOP" is etched on the narrower face and must always be fitted upwards.				
Piston Rings					
Ring Groove Width, Top ...	.0998	2.535			On earlier assemblies ring groove width was .098/.097" (2.489/2.464 mm.) and .0983/.0973" (2.497/2.472 mm.)
	.0988	2.510			
			.007	.1778	
			.005	.1270	
Compression Ring Width, Top	.0938	2.383			
	.0928	2.357			
Ring Gap ... ..	.017	.432			
	.012	.305			
Ring Loading Data					
(Automotive Eng. Co.) ...	Tangential Load	3.88/5.5 lb.	(2.09/2.49 kg.)		
	Wall Pressure	24.9/35.4 lbs./in. ²	(1.75/2.47 kg./cm. ²)		
(Wellworthy)	Cylinder Wall				
	Pressure	23.9/34.3 lbs./in. ²	(1.68/2.41 kg./cm. ²)		
	Diametrical Load	9.75/14.0 lb.	(4.42/6.35 kg.)		
	Tangential Load	3.70/5.30 lb.	(1.67/2.4 kg.)		
Ring Groove Width 2nd and 3rd ... ..	.0983	2.497			On earlier assemblies ring groove width was .098/.097" (2.489/2.464 mm.)
	.0973	2.471			
			.0055	.1397	
			.0035	.0890	
Compression Ring Width 2nd and 3rd ... ..	.0938	2.383			
	.0928	2.357			
Ring Loading Data					
(Automotive Eng. Co.) ...	Tangential Load	2.7/3.84 lbs.	(1.22/1.741 kg.)		
	Wall Pressure	17.4/24.6 lbs./in. ²	(1.22/1.73 kg./cm. ²)		
(Wellworthy)	Cylinder Wall				
	Pressure	20.8/29.4 lbs./in. ²	(1.46/2.07 kg./cm. ²)		
	Diametrical Load	8.5/12.0 lbs.	(3.90/5.44 kg.)		
	Tangential Load	3.2/4.5 lbs.	(1.45/2.04 kg.)		
Ring Groove Width 4th ...	.1915	4.864			
	.1905	4.839			
Duaflex Ring Width 4th ...	.1915	4.864			Fitted Width. Ring expands and occupies full width of groove.
	.1905	4.839			
Ring Loading Data	Tangential Load	7.5/10.5 lbs.	(3.40/4.76 kg.)		
			.0051	.130	
			.0031	.079	

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Scrapper Ring Width	.1874 .1864	4.760 4.735			Alternative to Duaflex
			.0065 .0035	.165 .089	
Scrapper Ring Width ...	.187 .185	4.750 4.699			Alternative to Duaflex
Ring Groove Width 5th ...	.1915 .1905	4.864 4.839			
Fitted Gaps—Rings					
1st ... ..			.009 .017	.229 .432	
2nd and 3rd ... ..			.009 .014	.229 .356	
Duaflex ... ..			.037 .018	.940 .457	
Scrapper Ring ... ..			.015 .010	.381 .254	Alternative to Duaflex
Flywheel and Starter Ring Gear					
Spigot Dia. for Starter Ring ...	13.094 13.091	332.588 332.511			
			— .031 — .023	— .787 — .584	
Inside Dia. of Starter Ring ...	13.068 13.063	331.927 331.800			
Flywheel mounting face Dia.	4.0007 3.9998	101.618 101.595			Run out of clutch contact face at outer diameter should not exceed .003" (.076 mm.)
Spigot Dia. of Crankshaft ...	4.0002 3.9995	101.605 101.588			
Camshaft					
Bore in Cylinder Block for Front Bearing	2.0007 1.9998	50.818 50.795			
			.0014 .0000	.036 .000	Provision made for the vernier setting of the valve timing with camshaft chain wheel on centre.
Outside Dia. of Front Bearing	1.9998 1.9993	50.795 50.782			
Inside Dia. of Front Bearing	1.5635 1.5620	39.713 39.675			
			.0045 .0025	.114 .064	
Dia. of Front Camshaft Journal	1.5595 1.5590	39.611 39.599			
Length of Front Journal ...	1.3775 1.3750	34.989 34.925			
			.0075 .0020	.191 .051	Camshaft End Float .004"-.008" (.1016-.2032 mm.)
Length of Front Bearing ...	1.3730 1.3700	34.874 34.798			
Outside Dia. of Rear Shell Bearings	1.8170 1.8155	46.152 46.114			
			— .0025 — .0048	— .064 — .122	

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Bore in Cylinder Block for Centre and Rear Shell	1.8122	46.030			
Bearings	1.8130	46.050	-.002	-.051	
			-.0043	-.109	
Outside Dia. of Centre Shell Bearing	1.8165	46.140			
Inside Dia. on Centre and Rear Shell Bearings ...	1.8150	46.101			
	1.6873	42.857			
	1.6855	42.812			
			.003	.076	
			.001	.025	
Dia. of Centre and Rear Journals	1.6845	42.786			
	1.6840	42.774			

Timing Chain

Pitch of Timing Chain ...	.375" (9.525 mm.)
No. of Pitches	62
Type of Chain	Endless roller

Water Pump

Housing Bore for Bearing ...	1.5749	40.003			
	1.5744	39.990			
			+.0007	+.018	
			-.0004	-.010	
Bearing—Outside Dia. ...	1.5748	40.000			
	1.5742	39.987			
Outside Dia. of Spindle for Impellor ... ..	.6264	15.910			
	.6256	15.890			
			-.0034	-.086	
			-.0021	-.053	
Inside Dia. of Impellor ...	.6235	15.837			
	.6230	15.824			
Dia. of Impellor Shaft for Bearings ... ..	.6299	15.999			
	.6296	15.992			
			+.0007	+.018	
			-.0004	-.010	
I/D of Bearings ... ..	.6303	16.010			
	.6295	15.990			

Thermostat

Makers No. X 43570/21 (Fitted up to Engine No. SJ 51167 E)

Valve begins to open ...	154° to 163°F. (68°C. to 73°C.)
Valve fully open	185°F. (85°C.)
Valve lift ... ..	.312" (7.94 mm.)

Makers No. 85035/70 (Fitted from Engine No. SJ 51168 E and future)

Valve begins to open ...	154°F. to 163°F. (68°C. to 73°C.)
Valve fully open	185°F. (85°C.)
Valve lift ... ..	.312" (7.94 mm.)

Makers No. 1572221 (Alternative, fitted from Engine No. SJ 51168 E and future)

Valve begins to open ...	156°F. to 165°F. (69°C. to 74°C.)
Valve fully open	185°F. (85°C.)
Valve lift ... ..	.36/.41" (9.1/10.4 mm.)

23C Diesel Engine

B.3

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Tappets					
Bore in Cylinder Block ...	.5630	14.300			
	.5623	14.282			
			.0012	.031	
			.0002	.005	
Tappet Stem Dia. ...	.5621	14.277			
	.5618	14.270			
Valves and Guides					
Inlet					
Outside Dia. of Inlet Valve	.502	12.751			
Guide ...	.501	12.725			
			.002	.051	
			.0002	.005	
Bore in Combustion Head ...	.5008	12.720			
	.5000	12.700			
Pressed in below top face of Combustion Head ...	.5000	12.700			
Inside Dia. of Inlet Valve	.3130	7.950			
Guide ...	.3120	7.925			
			.0023	.058	
			.0008	.020	
Dia. of Inlet Valve Stem ...	.3112	7.905			
	.3107	7.892			
Dia. of Inlet Valve Head ...	1.515	38.481			
	1.511	38.379			
Overall Length ...	4.352	110.541			
	4.342	110.287			
Valve lift ...	.349	8.865			
Exhaust					
Outside Dia. of Exhaust Valve	.5333	13.546			
Guide ...	.5323	13.520			
			.000	.000	
			-.002	-.051	
Bore in Combustion Head ...	.5323	13.520			
	.5313	13.495			
Pressed in below top face of Combustion Head ...	.32	8.128			
Inside Dia. of Exhaust Valve	.3755	9.538			
Guide ...	.3745	9.512			
			.0028	.071	
			.0013	.033	
Dia. of Exhaust Valve Stem ...	.3732	9.479			
	.3727	9.466			
Dia. of Exhaust Valve Head ...	1.220	30.988			
	1.216	30.886			
Overall Length ...	4.3565	110.655			
	4.3465	110.401			
Valve lift ...	.330	8.382			
Working Valve Tip Clearances (Cold)					
Inlet ...	.012	.305			Inlet valves fitted with loose caps "Free" type exhaust valves
Exhaust ...	.008	.203			

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Valve seating angle on valve head 45°.					
Valve seat angle in new cylinder head 44½°, but serviced at 45°.					
Valve Springs:					
Free Length	Inner	1.6	40.64		
	Outer	1.7	43.18		
Fitted Length	Inner	1.222	31.038		
	Outer	1.316	33.426		
Rate ...	Inner	56.8 lb. in. (65.44 kg. cm.)			
	Outer	106 lb. in. (122 kg. cm.)			
Hand of Helix	Inner	Left			
	Outer	Right			
Valve Timing (Crankshaft Degrees):					
Exhaust opens ...	...	45½° before B.D.C.			With rocker clearances set at .015" (.381 mm.) Inlet (cold) and .015" (.381 mm.) Exhaust (cold).
Exhaust closes ...	...	10½° after T.D.C.			
Inlet opens ...	...	10½° before T.D.C.			
Inlet closes ...	...	37½° after B.D.C.			
Exhaust Valve Seat Insert					
Outside Dia. of Seat Insert ...		1.5035	38.189		
		1.5025	38.164	-.0045	-.114
Bore in Combustion Head ...		1.500	38.1	-.0025	-.064
		1.499	38.075		
Depth of Seat Insert ...		.250	6.350		
		.248	6.299	+.002	+.051
Depth of recess in Combustion Head ...		.250	6.350	-.002	-.051
		.248	6.299		
Inlet Valve Seat Insert (Available for Service purposes).					
Outside Dia. of Seat Insert ...		1.6835	42.761		
		1.6826	42.738	-.0026	-.066
Bore in Combustion Head ...		*1.680	42.672	-.0045	-.114
		*1.679	42.647		
Depth of Seat Insert ...		.250	6.350		
		.248	6.299	.041	1.041
Depth of recess in Combustion Head ...		*.291	7.391	.039	.991
		*.289	7.340		
Ricardo Pre-combustion Chamber					
Dia. of Flange ...		1.4085	35.776		
		1.4075	35.750	-.003	-.076
Bore in Combustion Head ...		1.4065	35.725	-.001	-.025
		1.4055	35.700		

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Depth of Bore in Combustion Head ... ..	.188	4.775			
	.182	4.623			
			+.002*	+.051	*Due to chamfer on flange, hot plug will not stand proud of cylinder head face by more than .002".
			-.006	-.152	
Flange Depth ... ..	.188	4.775			
	.186	4.724			
Rocker Gear					
Bore in Rocker ... ..	.6805	17.285			
	.6793	17.254			
			+.0005	+.013	
			-.0007	-.018	
Outside Dia. of Rocker Bush	.6800	17.272			Press fit in housing
Inside Dia. of Rocker Bush when reamed in position ...	.6252	15.880			
	.6248	15.870			
			.0020	.051	
			.0011	.028	
Rocker Shaft Dia. ... ..	.6237	15.842			
	.6232	15.829			
Oil Pump					
	Approx. capacity at 50 lb. sq. in. (3.52 kg. sq. cm.) is 3.95 galls (16.94 litres) per min. at 2000 engine r.p.m. (Oil pump runs at engine speed).				
Oil Pressure	40 to 60 lbs. sq. in. (2.8 to 4.2 kg. sq. cm.).				
Outer rotor, Outside Dia. ...	1.5965	40.551			
	1.5975	40.577			
			.0075	.191	
			.0055	.140	
Bore in Pump Housing ...	1.604	40.742			
	1.603	40.716			
Major Dia. of Outer Rotor ...	1.417	35.992			Inner and outer rotors to be serviced as matched pairs.
	1.412	35.865			
Minor Dia. of Outer Rotor ...	.953	24.206			
	.954	24.232			
Major Dia. of Inner Rotor ...	1.172	29.769			
	1.171	29.743			
Minor Dia. of Inner Rotor ...	.731	18.567			
	.729	18.516			
Min. clearance on rotors ...			.004	.102	
			.0005	.0127	
					Measured when minor dia. of inner rotor and minor dia. of outer rotor are in line. Where clearance exceeds .010" (.254 mm.) new parts should be fitted.
Depth of Bore in Pump Body	.841	21.361			
	.840	21.336			
Depth of Bore in Front Bearing Housing ... ..	.157	3.988			
	.156	3.962			
Thickness of Joint Washer ...	.006	.152			

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Total depth including one Joint Washer	1.004 1.002	25.502 25.451			
			.0035 .001	.089* .025	*End clearance allowing for .002" (.051 mm.) compression of gasket A combined worn clearance of .005" (.127 mm.) indicates need of facing bearing housing recess.
Rotor Depth—Inner and Outer ... ..	.999 .998	25.375 25.349			
Outside Dia. of Oil Pump Bushes ... ..	.625	15.875	+ .0005 — .0002	+ .0127 — .0051	
Bore for Bushes ... ..	.6255 .6248	15.888 15.870			
Inside Dia. of Bush ... ..	.4995 .4990	12.687 12.674			
			.0015 .0005	.038 .013	End float of pump drive shaft must not exceed .010" (.254 mm.)
Dia. of Oil Pump Drive Shaft	.4985 .4980	12.661 12.649			
Injection Pump Drive					
Bore of Idler Gear ... ..	.7502 .7498	19.055 19.045			
			.0022 .0008	.056 .020	
	.749 .748	19.025 18.999			
Inside Dia. of Idler Gear Bush	.5005 .4995	12.713 12.687			
			.0017 .0002	.043 .005	
Dia. of Idler Gear Spindle ...	.4993 .4988	12.682 12.669			
Width of Idler Gear Bush ...	.756 .754	19.202 19.151			
			.007 .003	.178 .076	Idler gear backlash: .004" to .006" (.1016 mm. to .1524 mm.)
Width of Idler Gear Hub ...	.751 .749	19.075 19.025			
Inside Dia. of Bush	1.0005 .9998	25.412 25.395			
			.0025 .0008	.064 .020	
Driving Gear Spigot Dia. ...	.999 .998	25.375 25.349			
Outside Dia. of Bush for Driving Gear	1.2513 1.2509	31.783 31.772			
			— .0015 — .0004	— .038 — .010	
Housing Bore	1.2505 1.2498	31.763 31.745			
Rear Oil Seal					
Rear Cover	5.126 5.124	130.200 130.150			
			— .009 — .003	— .229 — .076	

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Oil Seal	5.133	130.378			
	5.129	130.277			
Oil Seal Inside Dia.	4.000	101.6			
			-.0002	-.005	
			+.0005	+.013	
Crankshaft	4.0002	101.605			
	3.9995	101.587			
Crankshaft Pulley					
Inside Dia. of Pulley Hub ...	1.1255	28.588			
	1.1248	28.570			
Dia. of Front End of Crankshaft	1.1248	28.570			
	1.1243	28.557			
Outside Dia. of Pulley ...	5.75	146.05			
Injectors					
Early engines—without heat shields.	Up to Engine No. SJ 86045E.				
Nozzle Holders	CAV type BKB 40S 697				
Nozzles	CAV type BDN 12SP 6169.				
	Working pressure 130 ats.				
	Initial Setting (new injectors) 135 ats.				
Engines fitted with heat shields.	Engine No. SJ 86046E to SJ 125724E.				
Nozzle Holders	CAV type BKB 40S 697K				
Nozzles	CAV type BDN 12SP 6169 A or BDN 12SP 6262.				
	Working pressure 130 ats.				
	Initial Setting (new injectors) 135 ats.				
	Engine No. SJ 125725E and subsequent.				
Nozzle Holders	CAV type BKB 40S 697K				
Nozzles	CAV type BDN 12SP 6290.				
	Working pressure 130 ats.				
	Initial Setting (new injectors) 135 ats.				
Pintaux Nozzles	Pintle Angle 12°	Seat Angle 60°	Orifice Sizes: Main .0846/.0728"		
			Auxiliary 0.2 mm. ±.015 mm.		
Injection Pump	D.P.A. 3240011, D.P.A. 3240012, D.P.A. 3240013, D.P.A. 3240015, Injection timing 19° before T.D.C.				
	D.P.A. 3242643 (fitted with light load advance), D.P.A. 3242645 (fitted with light load advance). Injection timing 13° before T.D.C.				
	Timing hole in flywheel and cylinder block when aligned with ¼" dia. tommy bar locates engine at 16° before T.D.C				
Governor	Variable speed mechanical type, integral with injection pump.				
Fuel Lift Pump	A.C. type Y.D., driven off eccentric at rear of camshaft				
	Delivery Pressure: 4-7 lbs./sq. in. (.28-.49 kg. sq. cm.).				
Cold Starting Equipment ...	C.A.V. Thermostart, fitted to inlet manifold; or Ki-gass equipment.				
Air Cleaner	A.C. Oil Bath Type.				
Starter Motor	M 45 G. with self-indexing plate clutch drive.				
	Out of mesh clearance between starter pinion and flywheel gear ring. ⅛" ± ⅜" (3.17 ± 2.38 mm.).				
	No. of Teeth in flywheel gear ring and starter pinion 113 and 11 respectively.				

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Batteries					2 off, 6 volt. connected in series MHF 115E, MHF.P 115E, MHF.PZ 115E Amp. hour capacity: at 10 hour rate—38 amp. hour. at 20 hour rate—43 amp. hour.
Dynamo					C39P2. Type: 2 Pole, 2 Brush, Shunt wound, compensated voltage control. Runs at 1.72 x engine speed.

3-A-152 DIESEL ENGINE

No. of Cylinders	3.	
Bore	3.6" (91.44 mm.)	
Stroke	5" (127 mm.)	
Cubic Capacity	152.7 cu. ins. (2,502 c.c.)	
Compression Ratio	17.4 : 1.	
Firing Order	1, 2, 3.	
Brake H.P. (Bare Engine) ...	37. *	*Subject to official confirmation
Belt H.P.		
Equivalent Crankshaft Torque ...		

TIGHTENING TORQUES

Cylinder Head Nuts	55 - 60 lbs. ft. (7.60 - 8.29 Kg. m.)
Connecting Rod Nuts	70 - 80 lbs. ft. (9.68 -11.06 Kg. m.)
Main Bearing Setscrews	110 -120 lbs. ft. (15.21 -16.59 Kg. m.)
Flywheel Setscrews	75 lbs. ft. (10.37 Kg. m.)
Balance Weight Setscrews ...	50 - 55 lbs. ft. (6.91 - 7.60 Kg. m.)
Nozzle Cap Nuts	50 lbs. ft. (6.91 Kg. m.)

DIMENSIONS AND TOLERANCES

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Main Bearings					
Housing Bores	2.9165	74.079			
	2.9175	74.104			
Main Bearing Bore (Ref. only)	2.75126	69.8819			
	2.75276	69.920			
Crankshaft Clearance ...			.00226	.05730	Measured assembled.
			.00426	.11810	
Crankshaft					
Main Journal Dia.	2.7490	69.824			
	2.7485	69.811			
Crankshaft Endfloat					
Rear Main Width	1.87725	47.682			
	1.87425	47.6059			
Crank Endfloat ... ..			.002	.0508	
			.011	.279	

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Thrust Washer Thickness ...	.123	3.124			
(Top and Bottom) ...	.125	3.175			
Thrust Washer Dia. ...	3.552	90.220			
(Top and Bottom) ...	3.562	90.475			
			.002	.0508	
			— .020	— .508	
Cylinder Block Recess for	3.572	90.729			
Thrust Washer ...	3.564	90.526			
Dowel—Main Bearing Cap	.750	19.050			
Diameter ...	.751	19.075			
			— .0015	— .038	
			± .00075	± .019	
Cylinder Block Bore for	.75075	19.069			
Dowel ...	.7495	19.037			
Big End					
Crankpin Diameter ...	2.249	57.125			
	2.2485	57.112			
			.00325	.0825	
			.00175	.0444	
Bearing Bore ...	2.25175	57.1944			
	2.25075	57.1690			
Conn. Rod Bore ...	2.3955	60.846			
	2.3950	60.833			
Conn. Rod Big End Width ...	1.5525	39.434			
	1.5502	39.375			
Big End Endfloat ...			.0095	.2413	
			.0148	.3759	
Crankpin Width ...	1.565	39.751			
	1.562	39.674			
Small End					
Small End Bore ...	1.37475	34.918			
	1.37620	34.955			
			— .00525	— .1333	
			— .0023	— .0584	
Small End Bush ...	1.3785	35.014			
(External Dia.) ...	1.3800	35.052			
Small End Bush ...	1.2505	31.763			
(Internal Dia.) ...	1.2515	31.788			
			.0005	.0127	
			.00175	.0444	
Gudgeon Pin Dia. ...	1.250	31.75			
	1.24975	31.743			
			— .0005	— .0127	
			— .00025	— .0063	
Gudgeon Pin Holes in Piston	1.250	31.75			
	1.2495	31.737			

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Rod Alignment between Big and Small-end bores with small-end bush fitted.	At 5" Centres (127 mm.)		±.005" (.127 mm.)		Measured on each side of axis of rod on test mandrel.
Cylinder Block and Liners					
Cylinder Block Bore ...	3.6875	93.662			
	3.6885	93.687			
			+.001	+.0254	
			-.001	-.0254	
Liner ...	3.6885	93.687			
	3.6875	93.662			
Top Flange of Liner ...	.045	1.143			
(Thickness) ...	.040	1.016			
			.001	.0254	Below block top face.
			.009	.2286	
Recess for Top Flange of Liner	.046	1.1684			
	.049	1.2446			
Liner—Top Dia. (Flange) ...	3.810	96.774			
	3.805	96.647			
			.005	.127	
			.015	.381	
Cylinder Block—Top Bore for Liner ...	3.815	96.901			
	3.820	97.028			
Total Height of Cyl. Block ...	13.7445	349.110			
	13.7395	348.983			
Pistons and Sleeves					
Liner Bore ...	3.6015	91.478			
	3.6025	91.503			
Ring Groove Width ...	.0957	2.4307			Three compression and one scraper fitted above the gudgeon pin and one scraper fitted below.
(Top, 2nd and 3rd)	.0967	2.4561			
			.0019	.0482	
			.0039	.099	
Compression Ring Width ...	.0938	2.382			
(Top, 2nd and 3rd) ...	.0928	2.357			
Scraper Ring Groove Width	.252	6.400			
	.253	6.426			
			.002	.0508	
			.004	.1016	
Scraper Ring Width ...	.250	6.35			
	.249	6.324			
Fitted Gaps—Rings, Compression and Scraper ...	.009	.2286			
	.013	.3302			
Camshaft					
Journal Dia. (No. 1) Front ...	1.870	47.498			
	1.869	47.472			
			.004	.1016	
			.008	.2032	
Housing Bore (No. 1) Front	1.877	47.675			
	1.874	47.599			

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Journal Dia. (No. 2) Centre	1.860	47.244			
	1.859	47.218			
Housing Bore (No. 2) Centre	1.867	47.421	.004	.1016	
	1.864	47.345	.008	.2032	
Journal Dia. (No. 3) Rear ...	1.840	46.736			
	1.839	46.710			
Housing Bore (No. 3) Rear ...	1.847	46.913	.004	.1016	
	1.844	46.837	.008	.2032	
Camshaft Spigot Dia. ...	1.9995	50.787			
	1.9985	50.761			
Camshaft Gear Bore... ...	2.001	50.825	.0000	.0000	
	1.9995	50.787	.0025	.0635	
Camshaft Endfloat					Controlled by leaf spring affixed at rear of timing case front cover.
Cam Lift ... ..	.3085	7.836			
	.3165	8.039			
Tappets and Valves					
Bore in Head ... ..	.62575	15.894			
	.6245	15.862			
Tappet Stem Dia. ... ..	.62375	15.843	.00075	.019	
	.62225	15.805	.0035	.088	
Valve Tip Clearance					
Inlet (Cold) ... ..			.012	.3048	
Exhaust (Cold) ... ..			.012	.3048	
Valve Stem Dia. ... ..	.311	7.899			
	(Inlet and Exhaust) ...	.312			
Valve Guide Bore ... ..	.3155	8.013	.002	.0508	
	(Inlet and Exhaust) ...	.3140	.0045	.1143	
Valve Guide—Outside Dia....	.501	12.725			
	.5005	12.712			
Cylinder Head Hole for Guide	.5005	12.712	.0000	.0000	
	.4995	12.688	.0015	.0381	
Valve Head (Inlet and Exhaust) Clearance below Cylinder Head Face (New)	.070	1.778			Not to exceed .140" (3.556 mm.) after regrinding.

3-A-152 Diesel Engine

B.4

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Valve Head Dia.					
Inlet	1.536	39.014			
	1.532	38.913			
Exhaust	1.317	33.452			
	1.313	33.350			
Guide Projection above Spring Seat—					
Inlet ... ..	.59375	15.081			
Exhaust ... ..	.59275	15.056			
Valve Seating Angle on Valve Head		90° inclusive			
Valve Seat Angle on New Cylinder Head		88° inclusive			
Valve Springs					
Fitted Length: Inner ...	1.1875	30.162			Free Length: Inner 1.365" (34.671 mm.)
					1.405" (35.687 mm.)
Outer ...	1.5	38.100			Outer 1.803" (45.796 mm.)
					1.783" (45.289 mm.)
Fitted Load: Inner ...	8 lb. ± 1 lb.	3.629 ±	.454 kg.		
Outer ...	22.75 ± 2 lb.	10.319 ±	.907 kg.		
Full Lift Load:	Inlet				Outlet
Inner ...	23 ± 2 lb.	10.433 ±	.907 kg.		23 ± 2 lb. 10.433 ± .907 kg.
Outer ...	50 ± 2 lb.	22.68 ±	.907 kg.		50 ± 2 lb. 22.68 ± .907 kg.
Rocker Shaft Dia. ... ..	.62375	15.843			
	.62225	15.805			
			.00075	.019	
			.0035	.088	
Bush Rocker Lever Bore ...	.6245	15.862			
	.62575	15.894			
Timing Gear					
Crankshaft Dia. for Gear ...	1.5005	38.1127			
	1.500	38.100			
			-.001	-.0254	
			+.001	+.0254	
Crankshaft Gear Bore ...	1.501	38.1254			
	1.4995	38.087			
Crankshaft Dia. for Crank Pulley	1.5005	38.1127			
	1.500	38.100			
			.00025	.00635	
			.00175	.04445	
Crankshaft Pulley	1.50175	38.1444			
	1.50075	38.119			
Pulley—Crankshaft Seal Dia.	2.255	57.277			
	2.250	57.15			

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
	Crankshaft—Rear Seal Dia....	2.800 2.799	71.12 71.0946		
Idler Gear Hub Dia. ...	2.1238 2.123	53.944 53.924	.0012 .0036	.0304 .0913	
Idler Gear Bore ...	2.125 2.1266	53.975 54.016			
Idler Gear Hub Width ...	1.3275 1.3325	33.718 33.845			
Idler Gear Endfloat ...			.005 .015	.127 .381	
Idler Gear Width ...	1.3225 1.3175	33.591 33.464			
Idler Gear Hub Dia. ...	.8745 .8737	22.212 22.191	.000 .002	.000 .508	
Cylinder Block Bore ...	.87575 .8745	22.244 22.212			
Idler Retaining Plate Thick- ness ...	.140 .110	3.556 2.794			
Water Pump					
Shaft Diameter ...	.6267 .6262	15.918 15.905	— .0028 — .0015	— .0711 — .0381	
Pulley Bore ...	.6239 .6247	15.847 15.867			
Shaft Diameter ...	.6267 .6262	15.918 15.905	— .0017 — .00045	— .0431 — .0114	
Impeller ...	.62575 .6250	15.894 15.875			
Shaft Bearing Dia. ...	1.1811 1.1806	29.999 29.987	— .0011 — .0001	— .02794 — .00254	
Body-Bore for Bearing ...	1.1800 1.1805	29.972 29.984			
Fuel Pump Drive					
Gear Bore ...	1.750 1.751	44.45 44.475	.003 .0012	.0762 .0304	
Hub Gear Dia. ...	1.7488 1.7480	44.419 44.399			

Component Details	Dimensions New		Clearances New		Remarks
	Ins.	mm.	Ins.	mm.	
Lubricating Oil Pump					
Idler Gear Bore ... ..	.750	19.050			
	.751	19.075			
Idler Gear Bush—Outside Dia.	.7532	19.131	—.0032	—.0762	
	.7522	19.105	—.0012	—.0304	
Idler Gear Bush—Inside Dia.	.6572	16.692			
	.6562	16.667			
Shaft—Idler ... ..	.65535	16.645	.00085	.0215	
	.65475	16.630	.00245	.0622	
Pump Body Bore ... ..	.6545	16.624	—.00185	—.064	
	.6535	16.598	—.00025	—.00635	
Endfloat of Idler on Hub ...			.013	.330	
			.004	.1016	
Oil Pump Driver Gear Bore	.4964	12.608			
	.4972	12.628			
Oil Pump Drive Shaft ...	.4985	12.661	—.0021	—.0533	
	.4980	12.649	—.0008	—.0203	
Housing Bore—Oil Pump ...	.501	12.725	.003	.0762	
	.500	12.700	.0015	.0381	
Housing—Rotor Pocket Depth ... ..	.751	19.075			
	.750	19.050			
Housing—Rotor Pocket Dia.	1.603	40.716			
	1.604	40.741			
Driver Gear Boss Thickness	.515	13.081			
	.485	12.319			

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ENGINE

ENGINE

Section C

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3A-152 DIESEL ENGINE

THE 3A-152 ENGINE (Refer Figure 1)

The 3A-152 diesel engine is, as its numerical identification suggests, a 3-cylinder unit with a capacity of 152 cub. ins. (2.5 litres). This engine, by virtue of its combustion chamber design and nozzle location, combines the advantages of direct and indirect injection types.

This section is concerned with engine removal, overhaul and re-installation and, where applicable, includes reference to special toolage recommendations. Note that reference is made exclusively to the basic engine only, as the various components of the cooling, electrical and fuel systems are dealt with elsewhere in this Manual.

An important and often neglected aspect of engine reclamation work is the necessity for absolute

cleanliness. Many cases of unsatisfactory performance and short engine life, following reconditioning, can be directly attributed to inadequate attention to cleanliness.

It is considered prudent to mention that the continued use of an engine due for overhaul can be neither satisfactory nor economic, and cannot justify the increasing risk of total failure and additional repair charges.

The repair instructions covered within this section assume that the engine has been removed from the tractor.

Reference to left and right hand should be interpreted as seen from the driving seat.

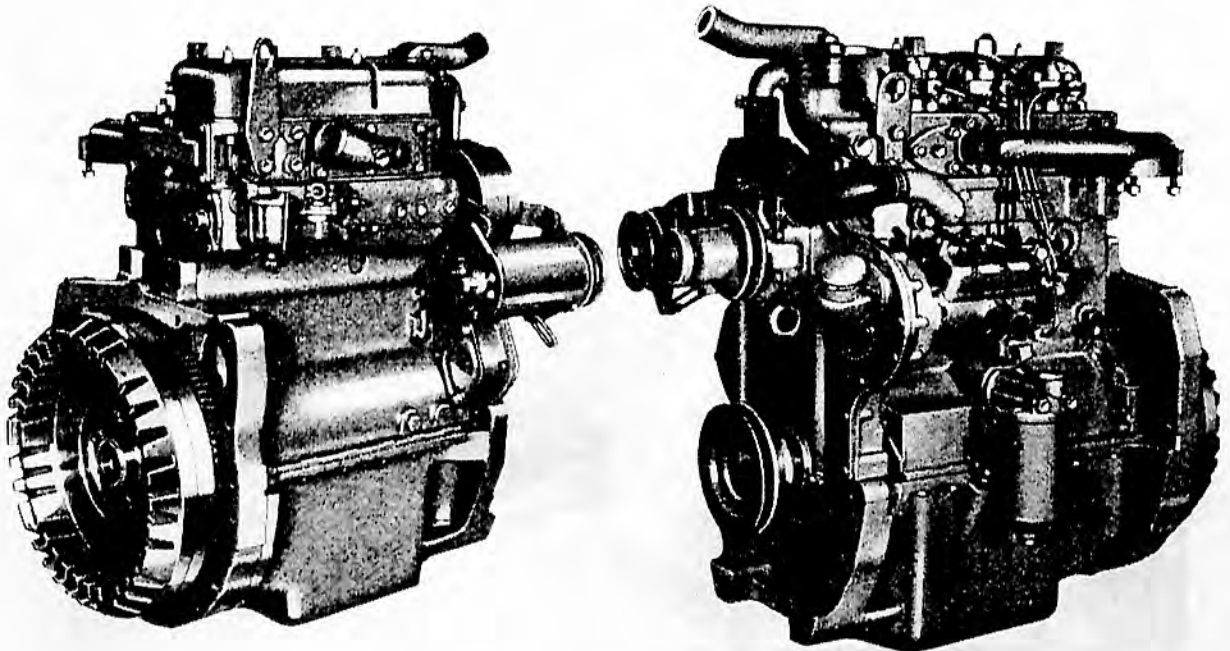


FIGURE 1
GENERAL VIEWS OF 3A-152 ENGINE

REMOVING THE ENGINE

Drain off water from radiator and cylinder block.
 Remove hood and cowl assembly.
 Disconnect and remove batteries.
 Remove fuel tank.
 Remove radiator.
 Disconnect fuel supply lines to engine.
 Disconnect throttle and stop control links.
 Disconnect starter motor and generator connections.
 Remove starter motor.
 Disconnect steering drag links to left and right hand track arms.
 Apply parking brake and chock rear wheels.

Support engine and gearbox.

Remove front axle assembly.

Remove nuts and bolts securing engine to transmission housing.

Using special engine removal rig or, alternatively, a block and tackle, separate engine from transmission housing.

Assemble in reverse order.

When offering up engine clutch centre plate to the gearbox primary shaft it may be found advantageous to turn the crankshaft to permit the primary shaft and centre plate splines to line up.

Note.—It will be necessary to bleed the fuel system before attempting to start the engine.

THE CYLINDER HEAD

REMOVING THE CYLINDER HEAD

(Refer Figures 1 and 2)

Release hose clip securing breather pipe to rocker cover, and slide connecting hose clear of rocker cover.

Release the two clips which attach breather pipe to engine, and remove breather pipe.

Slacken off hose clips connecting thermostat housing to water pump, and remove rubber hose.

Remove oil feed pipe connecting cylinder head to camshaft chamber.

Remove injector pipe clip.

Remove injector pipes and leak-off pipes, and seal off all fuel unions.

Remove the injectors.

Remove the rocker cover.

Remove the rocker shaft, ensuring that the middle

two nuts are released first.

Slacken off and remove the cylinder head nuts in reverse sequence to that shown in Figure 2. Note that a plain washer is fitted to the waisted stud (No. 15).

Lift off the cylinder head and cylinder head gasket. Remove the thermostat from the water outlet body. Remove the inlet and exhaust manifolds. The cylinder head may be skimmed if required providing its thickness is not reduced below 2.98".

DISMANTLING THE ROCKER SHAFT ASSEMBLY (Refer Figure 3)

The removal of the retaining circlips at either end of the rocker shaft will enable the rockers, springs and pedestal brackets to be withdrawn.

Examine all components and renew as necessary. If rocker tips are worn it is advisable to fit new rockers.

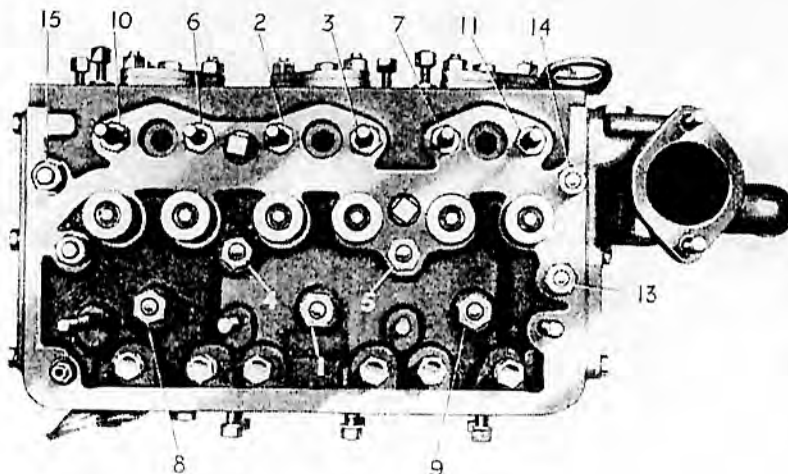


FIGURE 2
 SEQUENCE OF TIGHTENING
 CYLINDER HEAD NUTS

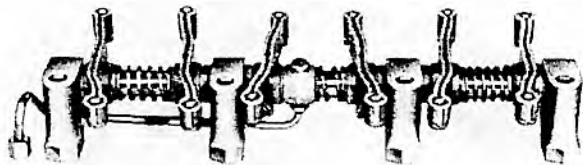


FIGURE 3
THE ROCKER SHAFT ASSEMBLY

REMOVING THE VALVES (Refer Figure 4)

Using a suitable Service Fixture or, alternatively, a valve spring compressor, remove valve cotters, valve caps, springs and valves.

Place valves and springs in a special stand or arrange them on the bench in the order in which they were dismantled. If the valves, after re-facing, are

considered fit for further service, they must be returned to their original locations.

VALVE SPRINGS (Refer Figure 4)

Two coil springs are fitted to each valve. Inlet and exhaust springs are identical, and as no damper coils are incorporated they may be fitted either way up. Before re-use, however, all valve springs should be carefully examined, with particular regard to squareness of ends. The fitted length of the inner spring is 1.1875" (30.16 mm.) developing a load of 8 lbs. (3.62 kgs.). The fitted length of the outer spring is 1.5" (38.1 mm.) developing a load of 22.75 lbs. (10.31 kgs.).

The valve and spring assembly is illustrated in Figure 4.

VALVE GUIDES (Refer Figure 5)

The valve guides are a press fit in the cylinder head. Their location being determined by a machined step in their outer diameter.

REMOVING VALVE GUIDES

(Refer Figure 5)

Valve guides can be removed and replaced using Service Tool P.D. 1A as illustrated in Figure 5.

When new valve guides are fitted the seats must be re-cut to ensure concentricity of the seat to the valve.

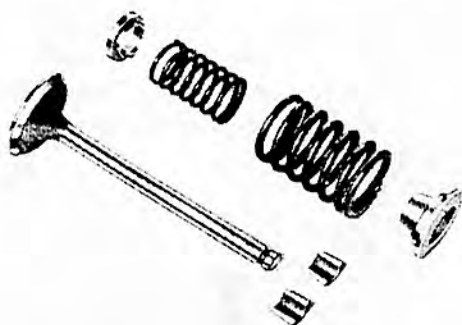
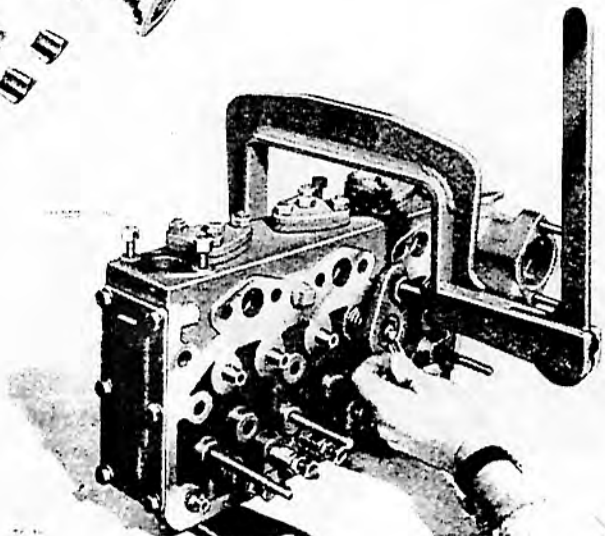


FIGURE 4
REMOVING THE VALVES



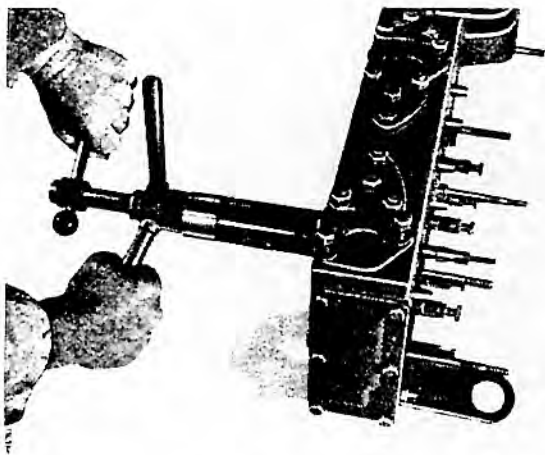


FIGURE 5
FITTING VALVE GUIDES

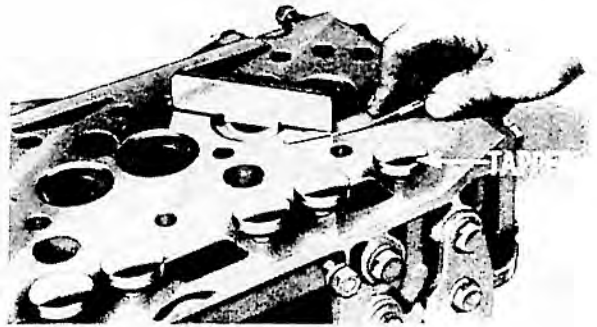


FIGURE 7
CHECKING VALVE HEAD DEPTH

VALVE SEATS (Refer Figures 6 and 7)

If the valve seats in the cylinder head show signs of pitting, burning or other evidence of leakage, they must be re-faced or re-ground according to their condition. Hand grinding is a finishing process and excessive grinding must be avoided, otherwise the seat angle may be altered and the seat width

increased. Excessive grinding will result in "grooving" of the valve face.

Valve seat reconditioning may be carried out using a proprietary seat grinding machine with a 44° stoned face. Figure 6 shows a valve seat being re-faced by means of a hand cutter.

When stoning or re-cutting valve seats, the minimum of metal should be removed to ensure that the seating face width is maintained as near as possible to original design and not necessarily increased.

Note that the maximum clearance between the cylinder head face and the valve head must not exceed 0.140" (3.556 mm.). This dimension can be checked using Service Tool P.D.17A as shown in Figure 7.

Valve seat inserts are not fitted to production engines. It is possible in most cases, however, to fit inserts to service engines where necessary, i.e., where the existing valve seat is worn or damaged to the point where re-cutting would place the relationship of the valve head to the cylinder head face beyond the service limits of .066"-.140" (1.676-3.556 mm.). This dimension applies equally to inlet and exhaust valves.



FIGURE 6
RE-CUTTING VALVE SEATS

HAND GRINDING

With the valves removed apply a small quantity of medium or fine grinding paste (depending on condition of valve and seat faces) to the valve face and insert valve into guide.

Using a suitable suction tool, rotate valve alternately in clockwise and anti-clockwise directions, occasionally raising the valve off its seat and revolving it a quarter turn before lowering it again. A light spring of suitable length, inserted between the valve head and guide will facilitate this operation.

Add more grinding paste as necessary, and continue as described above until an even, clean, matt-grey finish is obtained on a seating between $\frac{1}{16}$ " - $\frac{3}{32}$ " (1.58-2.38 mm.) in width. If such a condition cannot be obtained, it will be necessary to re-face or re-cut the valve and/or seat.

After grinding in the valves carefully, remove all traces of grinding paste.

TAPPETS (Refer Figure 7)

The tappets are of the mushroom foot type and operate directly in the cylinder head. With the cylinder head removed, it is necessary to remove the tappet adjusting screw and locknut before the tappets can be withdrawn. Note that the tappets must be free to rotate and capable of sliding in the cylinder head under their own weight. Tappet faces must not be re-ground. Damaged faces will necessitate the fitting of new tappets.

COMBUSTION CHAMBER CAPS

(Refer Figure 1)

The removal of the combustion chamber caps and the cleaning of the throat passages should be undertaken as a matter of course when cylinder head overhaul is carried out.

Care must be taken on replacing these caps to ensure that they are tightened up evenly. Where possible, new gaskets should be employed. The old gaskets, however, may be used, providing they are first annealed.

DECARBONISING

It is difficult to state a specific period at which decarbonising would be desirable. Provided the fuel system and injection equipment are properly maintained and a reputable grade of fuel is used, it is difficult to imagine the cylinder head being lifted purely for this purpose. Generally the need for decarbonising will not arise before the valves require attention.

To decarbonise the engine, proceed as follows :—

Remove cylinder head as previously described.

The valves, guides, rockers, etc., must be cleaned, examined and serviced as required.

Absolute cleanliness must be observed if particles of carbon, etc., are to be prevented from scoring cylinder walls, pistons, bearings, etc.

Carefully clean all carbon from the cylinder head and cylinder block faces and all cylinder head valve parts, ensuring that no burrs exist or are made on the machined faces.

With No. 1 piston midway down its bore, apply a smear of grease inside the top of No. 1 cylinder, and rotate crankshaft until No. 1 piston is at T.D.C. The grease serves as a seal between the piston crown and cylinder walls and prevents carbon becoming trapped between the piston and cylinder.

Cover No. 2 and 3 bores, and all water and oilways.

Using a suitable scraper, remove carbon from No. 1 piston crown, taking care not to scratch the piston and ensuring that a ring of carbon is left round the periphery of the piston crown.

Repeat the above operation for the remaining two pistons.

Clean all piston crowns and cylinder bores with a non-fluffy rag moistened in kerosene.

Lubricate piston crowns and bores and assemble cylinder head.

ASSEMBLING THE CYLINDER HEAD

(Refer Figures 2 and 8)

Thoroughly clean cylinder head and all components.

Lubricate valves, guides and tappets and assemble in head.

Refit induction and exhaust manifolds using new gaskets.

Lightly smear both faces of new cylinder head gasket with a suitable jointing compound.

Place gasket over cylinder head studs, noting that it is marked "Top front".

Fit and tighten cylinder head nuts in recommended sequence (Figure 2), ensuring that a plain washer is fitted to waisted stud No. 15.

Cylinder head nuts should be tightened to a torque of 55/60 lbs./ft. and rechecked after the engine has been run.

Replace the rocker assembly, ensuring that the slot at the rear end of the rocker shaft is in line with the punch mark on the rear pedestal bracket (Figure 8). The relationship of this slot to the

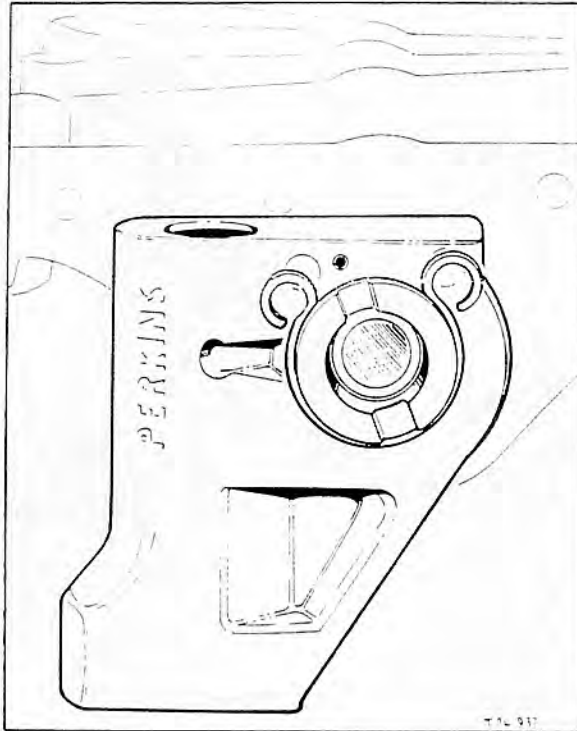


FIGURE 8
ROCKER SHAFT LOCATION MARK

punch mark determines the quantity of oil delivered to the rockers and bearings. Oil flow may be increased or decreased by rotating the shaft in a clockwise or anti-clockwise direction as required. It will generally be found that with the shaft slot and punch mark aligned the oil supply is most satisfactory.

Adjust valve clearances to 0.012" (0.305 mm.) inlet and exhaust.

Refit oil feed pipe between cylinder head and camshaft housing.

Replace injectors, using new washers, and connect up injector pipes and leak-off pipes.

Tighten injectors evenly.

Fit rocker cover and joint.

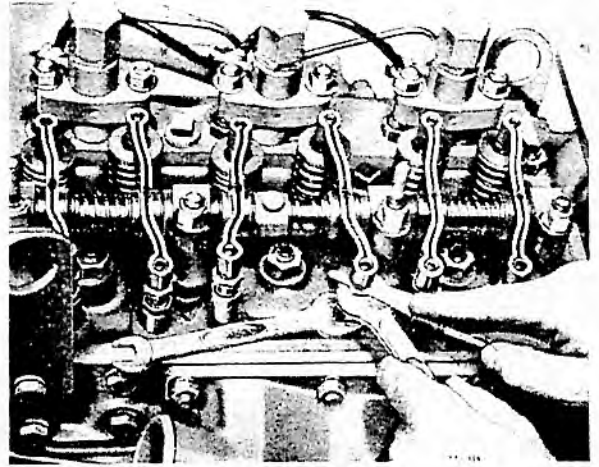


FIGURE 9
ADJUSTING TAPPETS

ADJUSTING VALVE CLEARANCE

(Refer Figure 9)

The three throw 120° crankshaft makes it necessary to adopt a slightly different sequence for tappet adjustment to the normal accepted procedure for four and six cylinder engines.

To adjust tappets proceed as follows :—

Remove the rubber plug in the inspection hole in the left front side of the transmission housing adaptor plate.

Rotate crankshaft until the T.D.C. line on the flywheel is in the centre of the inspection hole and No. 1 piston is on compression stroke (both valves fully closed).

Check and adjust clearances as necessary on Nos. 1, 2, 3 and 5 valves (Figure 9).

Turn crankshaft one revolution (360°) and repeat for Nos. 4 and 6 valves. (T.D.C. mark visible through inspection hole).

Replace rubber plug in adaptor plate.

Valve clearances for both inlet and exhaust should be set to 0.010" (0.254 mm.) hot, and 0.012" (0.305 mm.) cold.

THE LUBRICATING SYSTEM

The lubricating system is of the force feed type, the oil being circulated under pressure by a rotor type pump bolted to the front main bearing cap and driven via an idler gear by the crankshaft gear. Oil is drawn through a sump filter screen and a suction pipe before entering the oil pump, from whence it is pumped through a delivery pipe to a drilling in the cylinder block and to a full flow filter in the left hand side of the engine.

A plunger type relief valve is incorporated in the oil pump body. This relief valve is set to 50-65 p.s.i.

From the full flow filter the oil passes into the main oil gallery in the cylinder block. Passages in the main bearing webs of the crankcase carry the oil from the oil gallery to the main bearings.

The cylinder bores and gudgeon pins are splash lubricated. A transverse drilling at the front of the cylinder block feeds oil from the main oil gallery to an external pipe on the right hand side of the engine. This pipe feeds the centre camshaft bearing. Another external feed pipe connects the camshaft to the rocker assembly.

The camshaft is lubricated by oil draining from the rocker assembly through two oil-ways situated on either side of the centre camshaft bearing. A drilling connects the two chambers. The oil level is controlled by a weir in the front chamber.

Above No. 1 camshaft bearing there is a drilling which serves as a breather to the camshaft chamber and permits a free flow of oil passing over the weir. A drilling under the rear bearing of the camshaft prevents pressure build up between the rear camshaft journal and the tachometer housing seal.

The overflow from the camshaft weir is directed to lubricate the timing gears.

The flow of oil to the rocker assembly can be regulated by rotating the rocker shaft to align or restrict the oil feed passages.

LUBRICATING OIL FILTERS

The oil filters consist of : oil filler strainer, oil sump strainer, and main full flow oil filter.

THE OIL FILLER STRAINER (Refer Figure 10)

This is a coarse wide mesh strainer situated at the base of the oil filler tube.

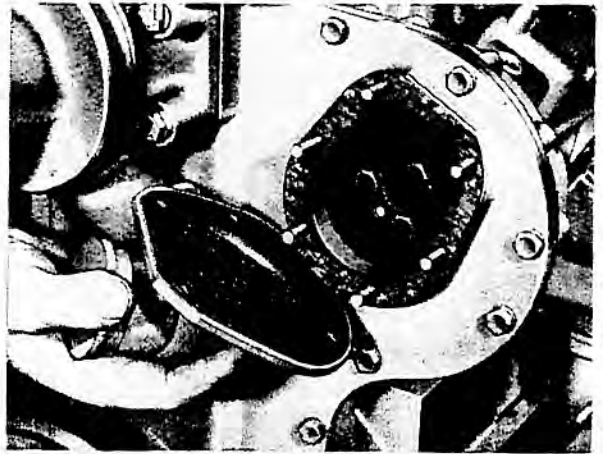


FIGURE 10
THE OIL FILLER STRAINER

THE SUMP STRAINER (Refer Figure 11)

The sump strainer consists of a perforated gauze wire strainer welded to the pressed steel cover at the bottom of the sump.

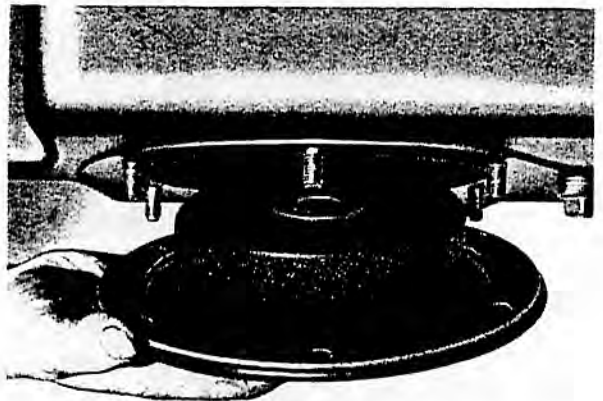


FIGURE 11
THE SUMP STRAINER

THE MAIN FULL FLOW FILTER

The main full flow filter is mounted on the left hand side of the engine crankcase. A replaceable type element is employed to extract foreign bodies from the circulating oil.

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