FiatTrattori
FIAT

355 C
455 C
505 C
605 C

Workshop Manual

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455 C
505 C
605 C

Workshop Manual

QUICK-REFERENCE INDEX

DIREZIONE COMMERCIALE

IMPORTANT

The Imperial weights and measures are given for operators' convenience and, though the closest approximation is sought, they are normally rounded off for practical reasons.
In case of discrepancies only the metric units should be considered.
The wear allowances indicated for some items are given for guidance only.
Any reference made in the manual to "front", "rear", "right-hand" and "left-hand" is as viewed facing the direction of forward travel from the driver's seat.
A.M. = Ante-modification — P.M. = Post-modification.

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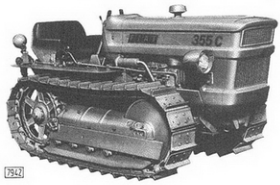
AGRICULTURAL CRAWLER TRACTORS



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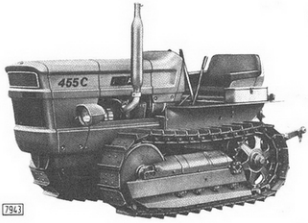
Model 355 C



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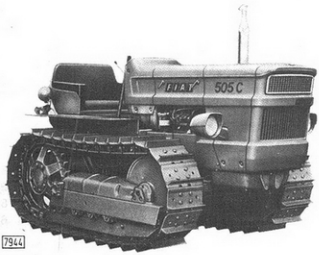
Model 455 C



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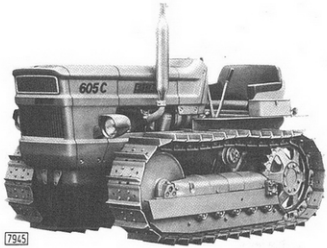
Model 505 C



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Model 605 C

CONTENTS

GENERAL

FOREWORD

The information given in this manual applies to the standard versions of Models 355 C, 455 C, 505 C, and 605 C.
Data and descriptions which do not carry any type reference apply to the four models.

SPECIFICATION

IDENTIFICATION DATA

Chassis Type	Engineering Code
355 C	632.500
455 C	632.200
505 C	634.200
605 C	636.200

ENGINE

Tractor Type	355 C	455 C	505 C	605 C
Engine Type	8025.02.011	8035.02.210 (1) 8035.02.310 (2)	8035.02.372 (2)	8045.02.211 (1) 8045.02.311 (2)
Cycle	Diesel	Diesel	Diesel	Diesel
Strokes	Four	Four	Four	Four
No. of cylinders	2	3	3	4
Bore	100 mm. (3.94 in.)	100 mm. (3.94 in.)	100 mm. (3.94 in.)	100 mm. (3.94 in.)
Stroke	110 mm. (4.33 in.)	110 mm. (4.33 in.)	110 mm. (4.33 in.)	110 mm. (4.33 in.)
Capacity	1728 cm³ (106.44 cu. in.)	2592 cm³ (159.16 cu. in.)	2592 cm³ (159.16 cu. in.)	3456 cm³ (210.88 cu. in.)
Compression ratio	17 to 1	17 to 1	17 to 1	17 to 1
Camshaft rotation (as seen from fan side)	Clockwise	Clockwise	Clockwise	Clockwise
Main bearings	Three	Three	Three	Three
Firing order	1 (180°)-2 (540°)	1-2-3	1-2-3	1-3-4-2
Rated engine speed	2500 r.p.m.	2400 r.p.m.	2600 r.p.m.	2200 r.p.m.
Max. no-load speed	2700 r.p.m.	2650 r.p.m. (1) 2600 r.p.m. (2)	2800 r.p.m.	2400 r.p.m.
Min. no-load speed	600 to 650 r.p.m.	650to700r.p.m.(1) 650 r.p.m. (2)	650 r.p.m.	650to700r.p.m.(1) 650 r.p.m. (2)
Alternator-to-engine speed ratio	1.83 to 1	1.83 to 1	1.83 to 1	1.83 to 1
Oil pump-to-engine speed ratio	.5 to 1	.5 to 1	.5 to 1	.5 to 1
Water pump/fan-to-engine speed ratio	1.42 to 1	1.42 to 1	1.42 to 1	1.42 to 1
Hourmeter rating	1750 r.p.m.	1600 r.p.m.	1840 r.p.m.	1600 r.p.m.
Output (fan, air cleaner and exhaust silencer removed)	35 HP	45 HP	50 HP	56 HP

(1) Bosch injection pump.
(2) C.A.V. injection pump.

Valvegear

Pushrod operated overhead valves.
Inlet opens 3° B.T.D.C.
Inlet closes 23° ABDC.
Exhaust opens 48° 30' B.B.D.C.
Exhaust closes 6° ATDC.

Valve clearance :
— For timing check . . . . . .45 mm (.018 in)
— Normal :
- Inlet . . . . . .25 mm (.010 in)
- Exhaust . . . . . .35 mm (.014 in)

Fuel System

Oil-bath air cleaner.
Fuel pump outlet line filters:—
— One cartridge, water separator (355 C).
— Twin, in-line, cartridge (water separator on first) (455 C-505 C-605 C).
Fuel injection pump:—
— In-line, plunger type pumping elements (355 C).
— Distributor type, Bosch or C.A.V. (455 C-505 C-605 C).
Lift pump:—
— Piston type (355 C).
— Twin-diaphragm type (455 C-505 C-605 C).
Automatic Advance Variator:—
— Mechanical (355 C).
— Hydraulic (455 C-505 C-605 C).
Four-orifice nozzle injectors
Release pressure 225 to 235 kg/cm² (3,200 to 3,342 p.s.i.)

Lubrication System

Forced-feed, gear type pump, featuring oil pressure regulating valve.
Normal lubricating oil
pressure . . . . . 3 to 4 kg/cm² (42.7 to 56.9 p.s.i.)
Oil filters:—
— Inlet line, gauze.
— Outlet line, full-flow, cartridge type, by-pass valve.

Cooling System

Vane type centrifugal water pump.
Wax type thermostat.
Vertical tube radiator core and fan.

MASTER CLUTCH

Dry single plate, overcentre engagement (355 C-455 C-505 C).
Dry twin plate, overcentre engagement (605 C).
Manual lever, mechanical.

GEARBOX AND SPEED-REDUCTION UNIT

Sliding-mesh gear, three forward and one reverse ratios.
Integral speed-reduction unit for a total of six forward and two reverse ratios.
Single gear selector lever.

BEVEL DRIVE

Centre bevel gear train in axle case.

BRAKES

Band-type on steering clutch drums.
Two independent pedals.
Brake lock lever (parking).

STEERING CLUTCHES

Dry, multi-plate, thrust spring, withdrawal sleeve.
Manual lever.

HUB-REDUCTION FINAL DRIVE

Spur gear train.

POWER TAKE-OFF

Transmission type.
Manual lever.
Engine speed at standard 540 r.p.m.:—
— Models 355 C - 455 C - 505 C . . 2160 r.p.m.
— Model 605 C . . . . . 1970 r.p.m.

BELT PULLEY

Manual lever.
Diameter width . . . . 250 x 150 mm. (9.84 x 5.90 in.)
Rated speed:—
— Model 355 C . . . . . 1300 r.p.m.
— Model 455 C . . . . . 1248 r.p.m.

— Model 505 C . . . . . 1352 r.p.m.
— Model 605 C . . . . . 1144 r.p.m.

UNDERCARRIAGE

Four track roller carriage assemblies (355 C-455 C-505 C).

Track carriage assemblies with five track rollers and one top idler (605 C).

Recoil spring type track tension assembly.

Transverse leaf spring front suspension.

Transverse rear suspension bar resting on track carriages.

TRANSMISSION RATIOS AND TRAVEL SPEEDS

Gear	Gearbox Ratios	Speed Reduction Ratios	Gearbox Speed Reduction Ratios	Engine-to-sprocket Ratios				Max. Travel Speed K.P.H. (M.P.H.)			
				Model 355 C	Model 455 C	Model 505 C	Model 605 C	Model 355 C	Model 455 C	Model 505 C	Model 605 C
1st	1/2.938	1/1.823	1/5.355	148.431	145.075	164.923	148.431	1.7 (1.05)	1.7 (1.05)	1.8 (1.11)	1.7 (1.05)
2nd	1/2.938	1	1/2.938	81.428	80.135	90.475	81.428	3.1 (1.92)	3.0 (1.86)	3.3 (2.05)	3.1 (1.92)
3rd	1/1.172	1/1.823	1/2.137	59.242	58.301	65.824	59.242	4.3 (2.67)	4.2 (2.61)	4.5 (2.79)	4.2 (2.61)
4th	1/0.853	1/1.823	1/1.555	43.099	42.415	47.888	43.099	5.9 (3.66)	5.7 (3.54)	6.2 (3.85)	5.8 (3.60)
5th	1/1.172	1	1/1.172	32.499	31.983	36.110	32.499	7.8 (4.84)	7.6 (4.72)	8.2 (5.09)	7.7 (4.78)
6th	1/0.853	1	1/0.853	23.644	23.268	26.271	23.644	10.7 (6.65)	10.4 (6.46)	11.2 (6.96)	10.6 (6.59)
1st Reverse	1/1.563	1/1.823	1/2.848	78.952	77.699	87.725	78.953	3.2 (1.98)	3.1 (1.92)	3.4 (2.11)	3.2 (1.98)
2nd Reverse	1/1.563	1	1/1.563	43.313	42.625	48.125	43.313	5.8 (3.60)	5.7 (3.54)	6.1 (3.80)	5.8 (3.60)

Bevel drive ratio:—
— Models 355 C-455 C-605 C (10/44) . . . . . 4.400 to 1
— Model 505 C (9/44) . . . . . 4.890 to 1

Hub-reduction final drive ratio:—
— Models 355 C-505 C-605 C . . . . . 6.300 to 1
— Model 455 C . . . . . 6.200 to 1

Overall ratio (bevel and hub):—
— Models 355 C-605 C . . . . . 27.720 to 1
— Model 455 C . . . . . 27.280 to 1
— Model 505 C . . . . . 30.800 to 1

P.T.O. drive ratio:—
— Models 355 C - 455 C - 505 C . . . . . 4.000 to 1
— Model 605 C . . . . . 3.642 to 1

Belt pulley drive ratio . . . . . 1.923 to 1

HYDRAULIC LIFT UNIT

Position-controlled lift with integral single cylinder (Models 455 C-505 C-605 C) and two single acting external cylinders (Model 355 C).
Engine driven gear type hydraulic pump drawing from lift body (455 C-505 C-605 C) or gearbox (355 C).

Rated output:—
— Model 355 C . . . 18.5 litres/min. (4 Gall./min.)
— Model 455 C . . . 17.8 litres/min. (3 7/8 Gall./min.)
— Model 405 C . . . 19.3 litres/min. (4 1/4 Gall./min.)
— Model 605 C . . . 16.3 litres/min. (3 1/2 Gall./min.)
Relief valve setting . . . 145 to 155 kg/cm² (2,062 to 2,204 p.s.i.)

Three-point linkage capacity:—
— Models 355 C-455 C Category 1
— Models 505 C-605 C Category 1 and 2

Rated load:—
— Model 355 C . . . 1000 kg (2,205 lb.)
— Models 455 C-505 C-605 C . . . . . 1200 kg (2,646 lb.)

Nominal lift capacity:—
— Model 355 C . . . 880 kgm (6,365 lb. ft.)
— Models 455 C-505 C-605 C . . . . . 840 kgm (6,075 lb. ft.)

ELECTRICAL SYSTEM (12 Volts)

Battery capacity at 20 hour discharge rate:—
— Model 355 C . . . 77 Ah
— Models 455 C-505 C 110 Ah
— Model 605 C . . . 136 or 143 Ah
Alternator . . . . . FIAT A 12 M - 124/12/42 X-M
— Maximum rating . . 53 Amps.
Voltage regulator . . . FIAT RC 2/12 B
Alternator warning relay . SIPEA or WEPOO

Starter:—
— Model 355 C . . . FIAT M 125 - 3/12 V. 2
— Models 455 C-505 C FIAT M 125 - 3/12
— Model 605 C . . . MARELLI MT 38 G A - QB

Output rating:—
— Models 355 C-455 C-505 C . . . . . 3 kW
— Model 605 C . . . 4 H.P.

WEIGHTS

Operating weight:—
— Model 355 C . . . 2035 kg. (4,487 lb.)
— Model 455 C . . . 2140 kg. (4,718 lb.)
— Model 505 C . . . 2500 kg. (5,512 lb.)
— Model 605 C . . . 2750 kg. (6,063 lb.)

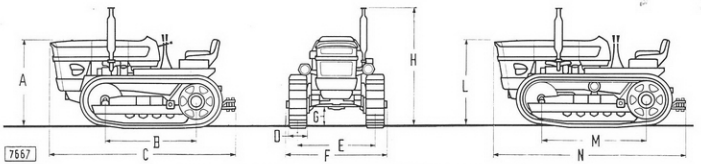


Fig. 1 - Overall Dimensions of Standard Tractors - mm. (in.).

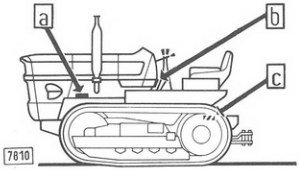
Model	A	B	C	D	E	F	G	H	L	M	N
355 C	1125 (44 1/4)	1293 (50 7/8)	2460 (97)	250 (10)	900 (35 3/8)	1182 (46 1/2)	250 (10)	1605 (63 1/4)	—	—	—
455 C	1210 (47 5/8)	1293 (50 7/8)	2675 (105 1/4)	250 (10)	1010 (39 3/4)	1292 (50 7/8)	250 (10)	1650 (65)	—	—	—
505 C	1230 (48 3/8)	1318 (51 7/8)	2675 (105 1/4)	310 (12 1/4)	1100 (43 1/4)	1440 (56 3/4)	270 (10 5/8)	1655 (65 1/8)	—	—	—
605 C	(L)	(M)	(N)	310 (12 1/4)	1100 (43 1/4)	1440 (56 3/4)	270 (10 5/8)	1655 (65 1/8)	1230 (48 3/8)	1528 (60 1/8)	2785 (109 5/8)

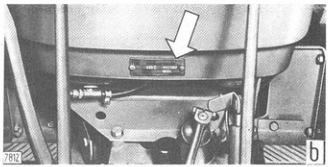
CAPACITIES

Description	Kg.	Litres	Imp. Units	Type of Fluid	
				FIAT Designation	International Designation
Fuel:—					
— Model 355 C	—	34	7 1/2 Gall	Diesel oil (decanted and filtered)	
— Models 455 C - 505 C - 605 C	—	54	12 Gall		
Coolant:—					
— Model 355 C	—	7	1 1/2 Gall	Water (1)	
— Models 455 C - 505 C . .	—	13	2 3/4 Gall		
— Model 605 C	—	14	3 Gall		
Engine oil					
Sump, filters and lines (2):—					
— Model 355 C	3.8	4.2	7 1/4 Pints		
— Models 455 C - 505 C . .	6.8	7.5	1 2/3 Gall		
— Model 605 C	10.5	11.5	2 1/2 Gall		
Sump only (2):—					
— Model 355 C	3.2	3.6	6 1/3 Pints		
— Models 455 C - 505 C . .	6.0	6.8	1 1/2 Gall		
— Model 605 C	9.5	10.5	2 1/3 Gall		
Injection pump/governor oil (2) (355 C)	.15	.16	1/3 Pint		
Air cleaner oil (2):—					
— Model 355 C	.50	.55	1 Pint		
— Models 455 C - 505 C - 605 C	.85	.94	1 2/3 Pints	**oliofiat AMBRA 20 W/40**	SAE 20 W-40 Multigrade detergent oil to MIL-L-2104 B containing EP additives
Gearbox/bevel drive/P.T.O. (455 C - 505 C - 605 C) oil .	11.1	12.5	2 3/4 Gall		
Gearbox/bevel drive/P. T. O. and hydraulic lift (355 C) oil (2) .	15.75	17.6	4 Gall		
Hub-reduction oil (each):—					
— Models 355 C - 455 C . .	.85	.95	1 2/3 Pints		
— Models 505 C - 605 C . .	5 (3)	5.5 (3)	9 2/3 Pints		
Belt pulley oil	.4	.44	3/4 Pint		
Track rollers and idler wheel oil .	—	—			
Hydraulic lift oil (455 C - 505 C - 605 C) (2)	3.2	3.5	6 1/4 Pints		
Grease nippels	—	—		**grassofiat G 9**	Lithium-base grease to NLGI No. 2

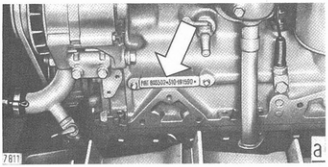
(1) At the beginning of the cold season use Fiat or other approved anti-freeze
(2) Use **oliofiat AMBRA 10 W/30** (SAE 10 W-30) for temperatures below 0° C.
(3) 7 Kg. - 7.8 litres (1 3/4 Gall) for Hill version

IDENTIFICATION DATA

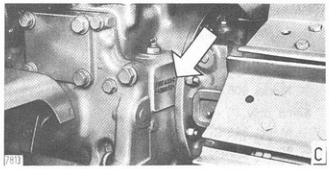




Data Plate.



Engine Number



Chassis Number

Fig. 2 - Location of Identification Data on the Tractor

SPARE PARTS

Whenever replacement parts are required it is essential that only genuine spares should be fitted to ensure efficient running.

When ordering, please state:—

- Tractor model.
- Chassis type and number.
- Engine type and number.
- Spare part number (see the Spare Parts Catalogue).

ENGINE

DESCRIPTION

The FIAT engines fitted to crawler tractors Models 355 C-455 C-505 C and 605 C are high-speed, 4-stroke, in-line Diesel units.

Engine Block - Single casting, dry cylinder liners, crankshaft and camshaft housings, valve tappet bores.

Cylinder Head - Integral valve seats.

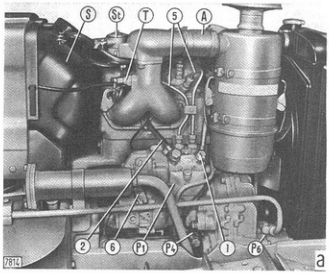
Valvegear - Helical train, pushrod operated camshaft, overhead valves. Inlet valves incorporate a fin to increase air turbulence.

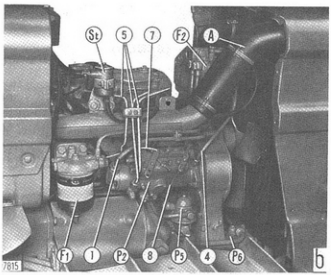
Crankgear - Crankshaft running on 3, 4, 5 bearings (Models 355 C, 455 C and 505, 605 C respectively) of the thin-shell type.

Light-alloy pistons, one compression ring and two oil control rings.

A flyweight-type dynamic balancer in the engine sump (605 C) reduces engine and engine-induced vibrations. On models 455 C and 505 C, an analogous result is obtained through a suitable belt pulley/engine flywheel balance.

Air Breathing - Through an oil-bath air cleaner.





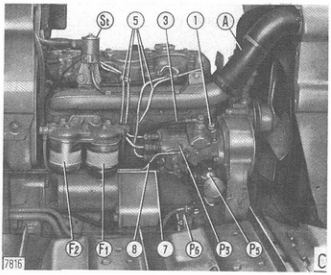


Fig. 3 - Right-hand Side Views of the Engines

(a) - Model 355 C
(b) - Models 455 C and 505 C
(c) - Model 605 C

A. Inlet manifold - F_1. First fuel filter - F_2. Second fuel filter - P_1. FIAT (Bosch licence) in-line fuel injection pump - P_2. C.A.V. distributor type fuel injection pump - P_3. Bosch distributor type fuel injection pump - P_4. Piston-type fuel lift pump - P_5. Diaphragm-type fuel lift pump - P_6. Hydraulic lift pump - S. Fuel tank. - St. Thermostarter bowl - T. Thermostarter - 1. Fuel injection pump inlet line - 2. Fuel leak-back line - 3. Fuel return line - 4. Fuel leak-back line to second fuel filter - 5. Fuel lines to injectors - 6. Throttle lever - 7. Throttle linkage - 8. Shut-off linkage.

Fuel Injection System - In-line piston type injection pump (355 C), Bosch or C.A.V. distributor type injection pump (455 C-505 C-605 C) and 4-orifice fuel injectors.

Lubrication System - Forced-feed, camshaft driven pump. Pressure relief valve on outlet line.

Cooling System - Centrifugal water pump, radiator and fan. Wax element thermostat.

Engine Starting - 12 Volt electromagnetically operated starter motor. Thermostarter (if applicable).

PERFORMANCE DATA

TEST PLAN

Engine on bench with fan, air cleaner and exhaust silencer removed.

Atmospheric pressure 740 ± 5 mm. Hg.

Ambient temperature 20° ± 3°

Relative humidity 70% ± 5.

Fuel density 830 ± 10 gram/litre.

Injection pump leak back fuel temperature 54° ± 2 °C. (Bosch and C.A.V. injection pumps only).

Injection timing B.T.D.C. cylinder No. 1 on compression stroke:—

— Model 355 C . . . . . 16° to 18°
— Model 455 C
  — Bosch . . . . . 7° to 9°
  — C.A.V. . . . . 16° to 18°
— Model 505 C (C.A.V.) . . . . . 16° to 18°
— Model 605 C
  — Bosch . . . . . 7° to 9°
  — C.A.V. . . . . 15° to 17°

PERFORMANCE DATA (BENCH)

Model 355 C	Engine r.p.m.	Engine H.P.		Time to burn 100 cm³ (6 cu. in.) of fuel seconds
		2 hour run-in	50 hour run-in	
Maximum (full load) (1)	2500	31.5 or over	33 or over	47.4 or over
Maximum torque (1)	1600	20.5 or over	21.5 or over	80.4 or over
Maximum (no-load) (1)	up to 2700	—	—	—
Minimum (no-load) (2)	600 to 650	—	—	—
P.T.O. at 540 r.p.m. (1)	2160	—	29.7 or over	55.1 or over

Model 455 C	Engine r.p.m.	Engine H.P.		Time to burn 100 cm³ (6 cu. in.) of fuel seconds
		2 hour run-in	50 hour run-in	
Maximum (full load) (1)	2400	42 or over	44 or over	36.7 or over (3) 35.4 or over (4)
Maximum torque:—				
— Bosch (1)	1400	28.5 or over	30.5 or over	53.5 or over
— C.A.V. (1)	1600	30 or over	32 or over	50.8 or over
Maximum (no-load):—				
— Bosch (1)	up to 2650	—	—	—
— C.A.V. (1)	up to 2600	—	—	—
Minimum (no-load):—				
— Bosch (2)	650 to 700	—	—	—
— C.A.V. (2)	650	—	—	—
P.T.O. at 540 r.p.m. (1)	2160	—	43,2 or over (3) 42,5 or over (4)	38,7 or over (3) 38 or over (4)

(1) Full throttle - (2) Throttle at idle - (3) Bosch pump - (4) C.A.V. pump

Performance Data (Bench) - Continued.

Model 505 C	Engine r.p.m.	Engine H.P.		Time to burn 100 cm³ (6 cu. in.) of fuel seconds
		2 hour run-in	50 hour run-in	
Maximum (full load) (1)	2600	47 or over	49 or over	31.5 or over
Maximum torque (1)	1600	32 or over	34 or over	47.8 or over
Maximum (no-load) (1)	up to 2800	—	—	—
Minimum (no-load) (2)	650	—	—	—
P.T.O. at 540 r.p.m. (1)	2160	—	43.8 or over	37.7 or over

Model 605 C	Engine r.p.m.	Engine H.P.		Time to burn 250 cm³ (15.2 cu. in.) of fuel seconds
		2 hour run-in	50 hour run-in	
Maximum (full load) (1)	2200	50.5 or over (3) 50 or over (4)	53 or over	77 or over (3) 76.9 or over (4)
Maximum torque:—				
— Bosch (1)	1600	39 or over	41 or over	103.4 or over
— C.A.V. (1)	1400	34 or over	36 or over	112.7 or over
Maximum (no-load) (1)	up to 2400	—	—	—
Minimum (no-load):—				
— Bosch (2)	650 to 700	—	—	—
— C.A.V. (2)	650	—	—	—
P.T.O. at 540 r.p.m. (1)	1970	—	49 or over	85 or over (3) 84 or over (4)

PERFORMANCE DATA (P.T.O.)

Same test conditions as for bench testing.

Model 355 C	r.p.m.		Engine H.P.		Time to burn 100 cm³ (6 cu. in.) of fuel seconds
	Engine	P.T.O.	2 hour run-in	50 hour run-in	
Maximum (full load) (1)	2500	625	30 or over	31.4 or over	47.4 or over
Maximum torque (1)	1600	400	19.5 or over	20.4 or over	80.4 or over
Maximum (no-load) (1)	up to 2700	up to 675	—	—	—
Minimum (no-load) (2)	600 to 650	150 to 162	—	—	—
P.T.O. at 540 r.p.m. (1)	2160	540	—	28.3 or over	55.1 or over
Model 455 C					
Maximum (full load) (1)	2400	659	39.9 or over	41.8 or over	36.7 or over (3) 35.4 or over (4)
Maximum torque:—					
— Bosch (1)	1400	384	27.1 or over	29.1 or over	53.3 or over
— C.A.V. (1)	1600	438	28.5 or over	30.4 or over	50.8 or over
Maximum (no-load):—					
— Bosch (1)	up to 2650	up to 728	—	—	—
— C.A.V. (1)	up to 2600	up to 713	—	—	—
Minimum (no-load):—					
— Bosch (2)	650 to 700	178 to 192	—	—	—
— C.A.V. (2)	650	178	—	—	—
P.T.O. at 540 r.p.m. (1)	2160	540	—	41 or over (3) 40,4 or over (4)	38,7 or over (3) 38 or over (4)

(1) Full throttle - (2) Throttle at idle - (3) Bosch pump - (4) C.A.V. pump

Performance Data (P.T.O.) - Continued.

Model 505 C	r.p.m.		Engine H.P.		Time to burn 100 cm³ (6 cu. in.) of fuel seconds
	Engine	P.T.O.	2 hour run-in	50 hour run-in	
Maximum (full load) (1)	2600	650	44.7 or over	46.6 or over	31.5 or over
Maximum torque (1) .	1600	400	30.4 or over	32.3 or over	47.8 or over
Maximum (no-load) (1)	up to 2800	up to 700	—	—	—
Minimum (no-load) (2)	650	162	—	—	—
P.T.O. at 540 r.p.m. (1)	2160	540	—	41.6 or over	37.7 or over

Model 605 C	r.p.m.		Engine H.P.		Time to burn 250 cm³ (15.2 cu. in.) of fuel seconds
	Engine	P.T.O.	2 hour run-in	50 hour run-in	
Maximum (full load) (1)	2200	604	48 or over (3) 47.5 or over (4)	50.3 or over	77 or over (3) 76.9 or over (4)
Maximum torque:—					
— Bosch (1)	1600	438	37.1 or over	38.9 or over	103.4 or over
— C.A.V. (1)	1400	384	32.3 or over	34.2 or over	112.7 or over
Maximum (no-load) (1)	up to 2400	up to 658	—	—	—
Minimum (no-load):—					
— Bosch (2)	650 to 700	178 to 192	—	—	—
— C.A.V. (2)	650	178	—	—	—
P.T.O. at 540 r.p.m . (1)	1970	540	—	46.5 or over	85 or over (3) 84 or over (4)

(1) Full throttle - (2) Throttle at idle - (3) Bosch pump - (4) C.A.V. pump

COMPRESSION TEST

If engine performance is found to be unsatisfactory, check the injection system (overhauling nozzles and injection pump) and the compression in each cylinder.

To check engine compression use tester Part No. **291310** proceding as follows:—

— Remove the injector from each cylinder.

— Fit dummy injector Part No. **292631** in place of the injector of the cylinder under test, and seal the housing using the associated copper washer.

— Hold the injection pump in engine stop condition and take the readings driving the engine through the starter.

In good running conditions, compression should be 26 to 28 kg/cm² (370 to 398 p.s.i.) as recorded at 40 °C sump oil temperature, 760 mm. Hg (sea level) atmospheric pressure with the engine running at 210 to 280 r.p.m. The minimum compression which is acceptable for a used engine is 22 kg/cm² (313 p.s.i.).

The maximum compression differential between cylinders is not to exceed 3 kg/cm² (42.7 p.s.i.).

In this connection it should be noted that every 100 metres (328 ft.) altitude increase from sea level results in 1 % (approx.) decrease in compression.

Insufficient compression may be due to faulty valves and seats, pistons and associated rings, cylinder liners or cylinder head gaskets.

Note : The purpose of the compression test is to assess the consistency of compression in the cylinders and to obtain an indication of the degree of wear affecting the parts which help to seal the combustion chambers. Therefore, the test results should not be taken as an absolute indication of engine efficiency.

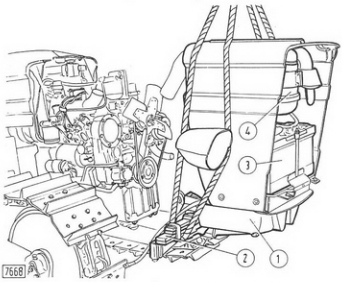


Fig. 4 - Removing the Front Mounting, Radiator and Front End Panelling (455 C - 505 C)

1. Front mounting - 2. Suspension - 3. Battery - 4. Air cleaner.

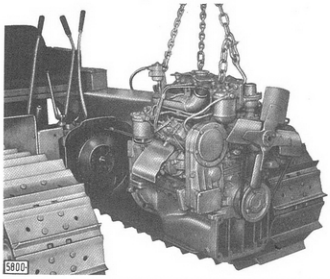


Fig. 5 - Removing (or Refitting) the Power Unit using Lifting Chain Part No. 290740 (455 C - 505 C)

TO REMOVE

Drain the cooling system, remove the lower side and centre panels, disconnect battery positive lead and starter positive cable.

Remove two slippers (28) and two suspension spring mounting brackets (27) (see Fig. 107). Place a stand under the gearbox.

Attach a lifting chain (see Fig. 4) and take up the weight, remove the suspension retaining screws, disconnect the piping and the electrical cables and lift off the mounting with attached battery, radiator and front end panelling.

Disconnect and remove the dashboard, take off the bonnet, the firewall (disconnecting the master switch and throttle linkage) and the fuel tank assembly.

Disconnect the hydraulic lift pipes (if applicable) from the associated pump.

Attach lifting chain Part No. **290740**, take up the weight, remove the gearbox retaining screws and withdraw the power unit (see Fig. 5).

To overhaul, place the engine on rotary stand Part No. **290090** using the brackets shown in Fig. 6.

TO REFIT

— Fill the clutch shaft housing in the flywheel with grassofiat G 9 or other approved grease.

— Attach the power unit to the transmission case with caution to avoid jamming the flywheel teeth against the clutch drive plate.

— For the correct tightening torque figures see page 169.

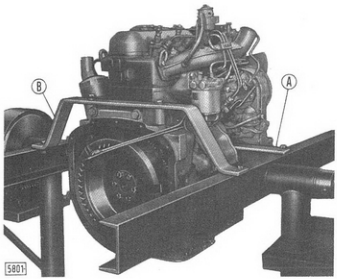


Fig. 6 - The Engine in position on Rotary Stand Part No. 290090

A. Front brackets part Nos. **290737** and **290738** - B. Rear bracket part No. **290739** (455 C - 505 C).

ENGINE BLOCK AND CYLINDER HEAD

BLOCK AND HEAD DATA

Engine Block	
Liner bore diameter machining oversize (see Fig. 8)	.2 mm (.008 in.)
Tappet housing machining oversize range (see Fig. 18)	.1 - .2 - .3 mm. (.004 - .008 - .012 in.)
Camshaft bearing housing diameter	See Fig. 14
Main bearing housing diameter	80.587 to 80.607 mm. (3.1727 to 3.1735 in.)
Cylinder Liners	
A.M. standard liner I.D. (1):—	
— Grade A	100.000 to 100.012 mm. (3.9370 to 3.9374 in.)
— Grade B	100.012 to 100.024 mm. (3.9374 to 3.9379 in.)
P.M. Standard liner I.D. (1) (see Fig. 8)	100.000 to 100.018 mm. (3.9370 to 3.9377 in.)
I.D. machining oversize range (2)	.2 - .4 - .6 - .8 mm (.008 - .016 - .024 - .032 in.)
Spare liner O.D. oversize	.2 mm. (.008 in.)
Interference fit	.080 to .160 mm. (.0031 to .0062 in.)
Cylinder Head	
Valve guide oversize (see Fig. 9)	.2 mm. (.008 in.)
Nominal height	.92 mm. (3.622 in.)

(1) Fitted liner diameter to be obtained after reboring and re-dressing. A maximum .1 mm. (.004 in.) machining oversize is allowed in production.
(2) The tolerance of each A.M. liner oversize is .024 mm. (.0009 in.) to be divided in two grades, A and B (.012 mm. - .0005 in.-each).

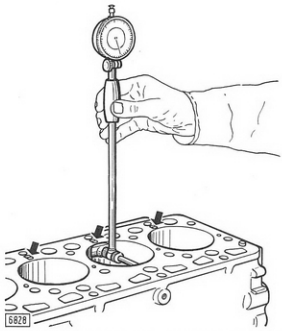


Fig. 7 - Checking Cylinder Liner I.D. using a Dial Gauge
Arrows indicate the grade of fit (A.M.)

ENGINE BLOCK

Ensure that the block is free from damage. Wash the casting in hot water and soda, subsequently rinsing in cold water.

Clean the internal passages using petrol and blow dry with compressed air.

Prior to fitting head and sump gasket ensure that the associated block faces are clean, check face parallelism and, if necessary, reface with a grinder.

CYLINDER LINERS

A.M. standard liners are graded as A and B according to their bore (see Data Table). The letters are stamped on the block top next to each liner (see Fig. 7). P.M. liners are ungraded.

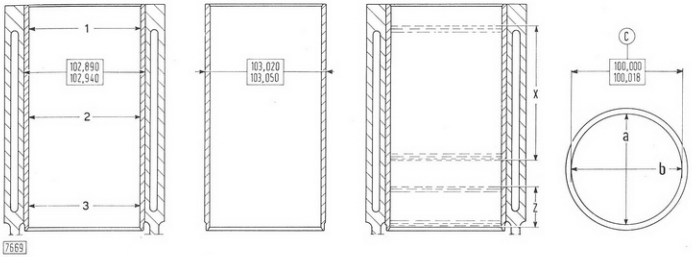


Fig. 8 - Liner and Block Details and Wear Data

a, b. Liner bore measuring points - C. P.M. fitted liner dimension (For A.M. liner see Data Table) - Z. Liner wear inspection length for assessment of piston fit; reading to be taken in plane b - X. Liner wear inspection length for assessment of out-of-roundness and taper; reading to be taken in planes a and b - 1, 2, 3. New/rebored liner dimensional check points; readings to be taken in planes a and b.

Inspect the liners for wear as follows:—

— Check the liner bore over the working length (see Fig. 8) as swept by the piston rings.

— The diameter reading should be taken in both the upper and lower part of the working length in plane parallel to the crankshaft (a) and in plane at right angles to it (b).

— Compare the reading to establish the amount of liner out-of-roundness and taper.

To assess the piston working clearance check the liner bore diameter in lower part (Z) in plane (b) only.

If out-of-roundness or taper in excess of .12 mm. (.0047 in) in detected, rebore to the oversize values specified in the Data Table, fitting pistons of the same grade (A.M pistons and liners only) and oversize. If A.M. oversize pistons are fitted, measure their diameter to assess the grade (not stamped in production).

To renew the liners press the old liners out from the bottom of the crankcase, using plate Part No. **292507** and press-fit the new liners from the top using plate Part No. **291501**.

Then bore and grind each liner as specified. Check the bore diameter by means of a dial gauge positioned in a and b (see Fig. 8) and take the readings in planes 1, 2 and 3.

If considerable out-of-round is detected, rebore to .2 mm. (.008 in.) oversize and use oversize liner.

CYLINDER HEAD

Check head flatness by placing the cylinder head on a surface plate and, if necessary, re-dress by scraping, or grinding if distortion is more severe.

When grinding, the maximum amount of material which can be removed should not exceed .5 mm. (.02 in.).

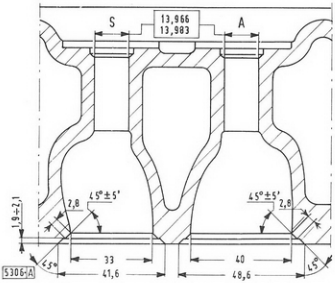


Fig. 9 - Valve Seat and Valve Guide Details

A. Inlet valve - S. Exhaust valve.

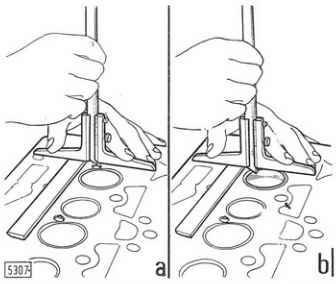


Fig. 10 - Checking Fuel Injector Protrusion (a) and Valve Depth in Cylinder Head

Injector protrusion = 2 to 2.5 mm. (.078 to .094 in.) - Valve depth = .7 to 1.1 mm (.027 to .043 in.) - Max. valve depth = 1.4 mm. (.055 in.).

When grinding place a copper washer of suitable thickness inside the injector seat to maintain protrusion value unchanged (see a, Fig. 10).

To recut the valve seats use tool Part No. **291113** and hand cutter Part No. **A. 60419** (292913). Check that the valve depth in the cylinder head is as shown in Fig. 10.

When refitting the cylinder head note the following:—

— Thoroughly clean both crankcase and head surfaces.

— Fit the gasket (self-adhesive) with the mark ALTO see d, Fig. 11) facing toward the cylinder head.

— Position the cylinder head and tighten the retaining screws according to the sequence given in Fig. 11.

OIL SUMP

In the course of overhaul, wash the oil sump in hot water and soda and rinse in cold water.

Ensure that the sump is free from damage or distortion, and inspect for oil leaks.

Check split seals (6 and 7, Fig. 25) and, if necessary, renew.

Using jointing compund, apply the gasket assembly onto the sump and retighten the screws to the specified torque.

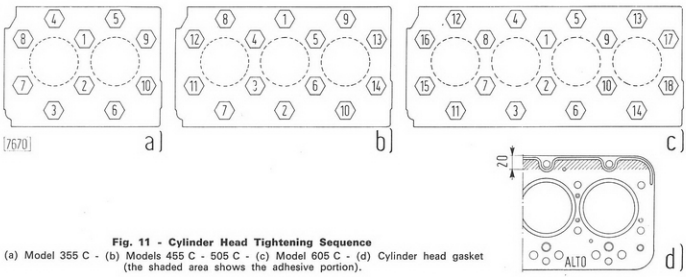


Fig. 11 - Cylinder Head Tightening Sequence

(a) Model 355 C - (b) Models 455 C - 505 C - (c) Model 605 C - (d) Cylinder head gasket (the shaded area shows the adhesive portion).

VALVEGEAR

VALVEGEAR DATA

Valve Timing Data	
Inlet opens	3° BTDC
Exhaust opens	48° 30′ BBDC
Inlet closes	23° ABDC
Exhaust closes	6° ATDC
Valve clearance :	
— For timing check	.45 mm (.018 in)
— Normal :	
- Inlet	.25 mm (.010 in)
- Exhaust	.35 mm (.014 in)
Cam lift — Inlet	5.705 mm. (.2245 in.)
Cam lift — Exhaust	5.777 mm. (.2273 in.)
Valve lift — Inlet	9.3 mm. (.366 in.)
Valve lift — Exhaust	10.2 mm. (.402 in.)
Camshaft	
Journal running clearance (see Fig. 14)	.080 to .160 mm. (.0031 to .0062 in.)
— Wear allowance	.20 mm. (.008 in.)
Bearing interference fit	.070 to .150 mm. (.0027 to .0059 in.)
Valves, Valve Guides and Springs	
Valve stem working clearance (see Fig. 16)	.023 to .053 mm. (.0009 to .0020 in.)
— Wear allowance	.20 mm. (.008 in.)
Standard valve guide O.D.	13.988 to 14.016 mm. (.5507 to .5517 in.)
Spare valve guide O.D. oversize	.2 mm. (.008 in.)
Valve guide interference fit	.005 to .050 mm. (.0002 to .002 in.)
Valve spring data:—	
— A.M. inner spring	
Free length	51 mm. (2.008 in.)
Length under 6.55 to 7.55 kg (14.44 to 16.64 lb.) (valve closed)	37.5 to 38.5 mm. (1.475 to 1.515 in.)
Length under 15.4 to 16.7 kg (33.95 to 36.82 lb.) (valve open)	26.8 to 28.8 mm. (1.055 to 1.139 in.)
— A.M. outer spring:—	
Free length	63 mm. (2.480 in.)
Length under 19.3 to 21.7 kg (42.55 to 47.84 lb.) (valve closed)	40.5 to 41.5 mm. (1.593 to 1.633 in.)
Length under 36.4 to 39.4 kg (80.26 to 86.87 lb.) (valve open)	29.8 to 31.8 mm. (1.173 to 1.251 in.)
— P.M. single spring (1):—	
Free length	66.5 mm. (2.617 in.)
Length under 30.1 to 33.9 kg (66.37 to 74.74 lb.) (valve closed)	40.5 to 41.5 mm. (1.593 to 1.633 in.)
Length under 48.1 to 52.1 kg (106.06 to 114.88 lb.) (valve open)	29.8 to 31.8 mm. (1.173 to 1.251 in.)
Tappets	
Spare crowned tappet oversize range (see Fig. 18)	.1 - .2 - .3 mm. (.004 - .008 - .012 in.)
Tappet working clearance	.030 to .068 mm. (.0012 to .0027 in.)
— Wear allowance	.15 mm. (.0060 in.)

(1) A red mark identifies single springs

Valvegear Data - Continued.

Rockers	
Rocker bush O.D.	21.030 to 21.060 mm. (.8279 to .8291 in.)
Bush housing diameter	20.939 to 20.972 mm. (.8243 to .8256 in.)
Bush interference fit	.058 to .121 mm. (.0023 to .0047 in.)
Fitted bush I.D.	18.016 to 18.034 mm. (.7092 to .7099 in.)
Rocker shaft diameter	17.982 to 18.000 mm. (.7079 to .7086 in.)
Rocker working clearance in shaft	.016 to .052 mm. (.0006 to .0020 in.)
— Wear allowance	.20 mm. (.008 in.)
Rocker spacer spring:—	
— Free length	59.5 mm. (2.343 in.)
— Length under 4.7 to 5.3 kg (10.4 to 11.7 lb.)	44 mm. (1.732 in.)
Valve Timing Gears	
Backlash	.08 mm. (.003 in.)
Idler gear jackshaft diameter	31.975 to 32.000 mm. (1.2589 to 1.2598 in.)
Idler gear bush fitted I.D.	32.050 to 32.075 mm. (1.2617 to 1.2627 in.)
Idler gear bush running clearance on jackshaft	.050 to .100 mm. (.0020 to .0040 in.)
— Wear allowance	.15 mm. (.0060 in.)
Idler gear thrust washer thickness	1.450 to 1.500 mm. (.0580 to .0590 in.)

CAMSHAFT

To take out the camshaft, remove the thrust plate (7) retaining screws (5, Fig. 13).

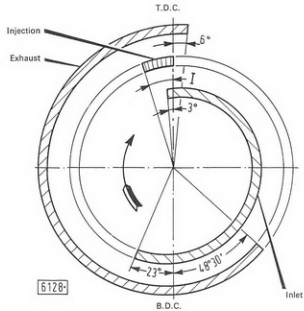


Fig. 12 - Valve Timing Diagram

A max. 5° angular tolerance is allowed - The above diagram applies to .45 mm. (.0177 in.) valve clearance - I = 16° to 18° (355C) ; 7° to 9°, Bosch pump (455 C - 605 C); 16° to 18°, C.A.V. pump (455 C - 505 C); 15° to 17°, C.A.V. pump (605 C).

To inspect, place the camshaft over V-blocks and, using a dial gauge, check the eccentricity, which should not exceed .02 mm. (.0008 in.).

Check both camshaft journals and associated bearings for wear and excessive running clearance. If the running clearance is found to exceed .20 mm. (.008 in.) the bearings should be renewed, if necessary, together with the camshaft itself.

To withdraw the bearings use a universal extractor and to refit use punches of suitable size.

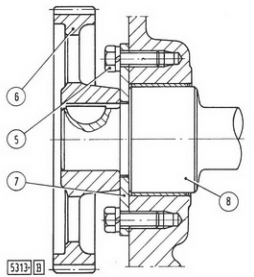


Fig. 13 - Sectional View of Camshaft Drive

5. Thrust plate retaining screws - 6. Drive gear - 7. Thrust plate - 8. Camshaft.

New fitted bearing bore diameter should be reamed to the values specified in Fig. 14.

VALVES
VALVE GUIDES AND SPRINGS

To remove and refit the valves use tool Part No. **291050** (see Fig. 15). After removal, clean the valves and check the stems for distortion and score marks.
If the valves show signs of defective sealing, hone together with the seats using air honer Part No. **290064** or hand honer Part No. **290891**. Subsequently, the parts involved should be carefully washed to eliminate all abrasive matter. If necessary, rebore the valve seats (see pages 19 and 20) and regrind the valves as necessary (see Fig. 16). The minimum land below valve head chamfer should not be less than .5 mm. (.020 in.).

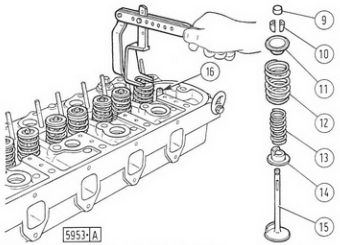


Fig. 15 - Removing (or Refitting) the Valves and A.M. Springs using Tool Part No. 291050

9. Valve lock cap - 10. Split cones - 11. Upper cup - 12. Outer spring - 13. Inner spring - 14. Intake valve lower cup - 15. Intake valve - 16. Valve guide.

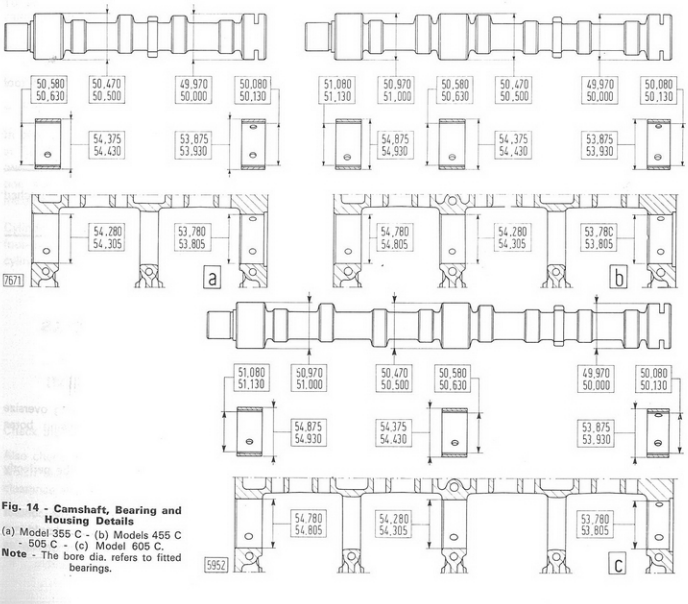


Fig. 14 - Camshaft, Bearing and Housing Details

(a) Model 355 C - (b) Models 455 C - 505 C - (c) Model 605 C.
Note - The bore dia. refers to fitted bearings.

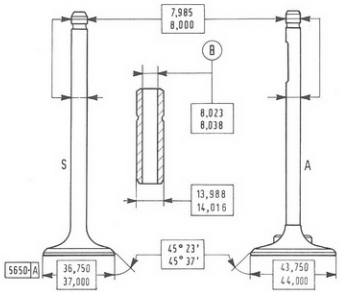


Fig. 16 - Valve and Guide Details
A. Inlet valve - B. Fitted diameter - S. Exhaust valve.
Note - The minimum land below valve head chamfer is .5 mm. (.020 in.)

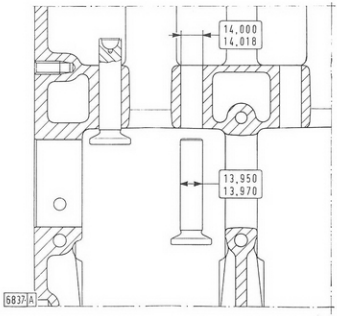


Fig. 18 - Tappet and Housing Details

To renew the valve guides use drift Part No. **291046** (see a, Fig. 17).

The valve guide bore surface should be perfectly smooth and free from score marks and evidence of pick-up.

The guides must be tight in their seats, otherwise renew using oversize guides (see Data Table).

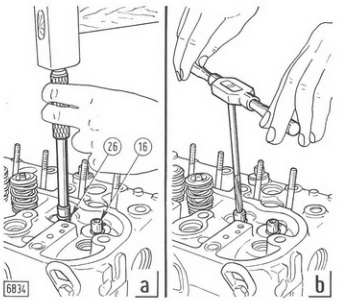


Fig. 17 - Refitting and Reaming the Valve Guides
a. Fitting the guide using drift Part No. 291046 - b. Reaming guide inner face using tool Part No. 291177 - 16. Valve guide - 26. Retaining ring.

After refitting, each guide should be reamed with tool Part No. **291177** (b, Fig. 17).

Check spring length (see Data Table).

Note: On refitting, make sure that the smaller pitched coils face toward the cylinder head mating plane.

TAPPETS PUSH RODS AND ROCKERS

Check tappet working clearance (see Fig. 18).

If excessive clearance is detected, renew using oversize tappets and open out the associated housing bores (see Data Table).

The surface in contact with the cam should be perfectly smooth, without any pits or dents.

The push rods should be perfectly straight, the contact surfaces between rods and adjusting screws should not show any sign of pick-up or abnormal wear. Renew as necessary.

To separate end bracket (20, Fig. 19) from rocker shaft (17) withdraw screw (V_1).

Check both the rocker shaft and bushes for wear and play. The contact surfaces of adjusting screws and rockers should be smooth and free from any sign of pick-up.

Inspect the rocker toes. When re-grinding becomes necessary, take care to remove as little material as possible.

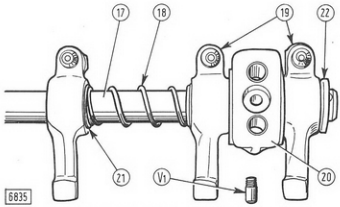


Fig. 19 - Rocker Assembly

V_1. Bracket-to-shaft retaining screw, featuring lubrication hole - 17. Rocker shaft - 18. Spring - 19. Rockers - 20. Bracket - 21. Thrust washer - 22. End cup.

TO ADJUST THE VALVE CLEARANCE

Use spanner Part No. **290886** and a feeler gauge (see Fig. 20). The correct clearance is .25 mm. (.010 in.) for both inlet and exhaust valves.

To adjust the valve clearance of 2/3-cylinder engines (355 C-455 C-505 C) proceed as follows:—

— Bring the valves of the cylinder involved in a condition of balance, turn the crankshaft by one full turn and adjust the clearance.

— Repeat the same procedure on the remaining cylinders.

In practice, the adjustment of 3-cylinder engines (piston at T.D.C. on compression stroke) can be performed when two valves of the other two cylinders (inlet valve for one and exhaust valve for the other) balance in the maximum opening position.

Cylinder matching for valve clearance adjustment on four-cylinder engines (605 C) is 1-4 and 2-3. Adjust a cylinder when the valves of the matching cylinder are in a condition of balance.

VALVE GEAR INSPECTION AND TIMING

Check the gears for damage or excessive wear.

Also check the tooth contact surfaces of each gear train which should be smooth and free from dents; running clearance should be .10 to .12 mm. (.0040 to .0047 in.).

When the Bosch or C.A.V. injection pump drive gear is to be renewed, note that it is marked with the engine model designation as the angular position of number "4", indicating the meshing position with respect to the shaft key, differs with the make of distributor type pump, as follows:—

— Model 455 C, Bosch pump, marked 8035, 127° 52 min. ± 15 min.

— Models 455 C-505 C, C.A.V. pump, marked 8035, 188° 54 min. ± 15 min.

— Model 605 C, Bosch pump, marked 8045, 52° 53 min. ± 15 min.

— Model 605 C, C.A.V. pump, marked 8045, 173° 24 min. ± 15 min.

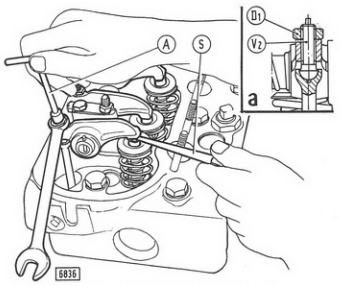


Fig. 20 - Adjusting Valve Clearance

a. Detail of rocker adjusting screw - A. Spanner Part No. 290886 - D_1. Locking nut - S. Feeler gauge - V_2. Adjusting screw.

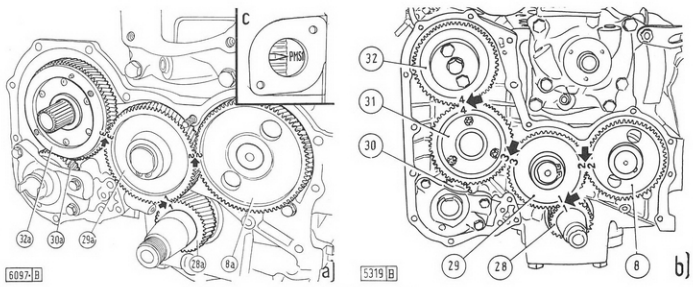


Fig. 21 - Valve Timing

(a) Model 355 C - (b) Models 455 C - 505 C - 605 C - (c) Detail of flywheel timing pointer indicating T.D.C. (P.M.S.) of piston 1. The arrows point to reference numbers 1-1, 2-2, 3-3 and 4-4 which should line up when cylinder No. 1 is at T.D.C. (P.M.S.) on compression stroke.

8 and 8a. Camshaft drive gear - 28 and 28a. Drive pinion - 29 and 29a. Idler gear - 30 and 30a. Hydraulic lift pump gear - 31. Fuel lift pump gear - 32 and 32a. Fuel injection pump gear.

Following gear removal, refit and time the valve gears (see Fig. 21) as follows:—

— Rotate the crankshaft until the piston of cylinder No. 1 is at T.D.C. (P.M.S.) in compression stroke.

— Refit the drive gears and line up pairs 1-1, 2-2, 3-3, 4-4 (see Fig. 21).

To check the valve timing angles (see Fig. 12) adjust the valve clearance to .45 mm. (.017 in.).

CRANKGEAR

CRANKGEAR DATA

Crankshaft and Bearings	
Main journal running clearance	.043 to .090 mm. (.0017 to .0035 in.)
— Wear allowance	.180 mm. (.0071 in.)
Crankpin running clearance	.021 to .058 mm. (.0008 to .0023 in.)
— Wear allowance	.180 mm. (.0071 in.)
Spare main and big-end bearing undersize range (see Figs. 22 and 29) (1)	.254 - .508 - .762 - 1.016 mm. (.010 - .020. - 030 - .040 in.)
Main journal crankpin machining undersize range (see Fig. 22) (1)	.254 - .508 - .762 - 1.016 mm. (.010 - .020 - .030 - .040 in.)
Crankshaft end float	.082 to .334 mm. (.0032 to .0131 in.)
— Wear allowance	.40 mm. (.0157 in.)
Spare thrust washer thickness oversize	.127 mm. (.0050 in.)

(1) Crankshafts featuring .1 mm. (.0040 in.) undersize main journals/crankpins and bearings may be fitted in production only.

Crankgear Data - Continued.

Pistons	
Standard diameter, at 50 mm. (1.97 in.) from skirt base (see Fig. 27) applicable to:—	
— A.M. pistons (1st solution)	
Grade A	99.834 to 99.846 mm. (3.9304 to 3.9309 in.)
Grade B	99.846 to 99.858 mm. (3.9309 to 3.9314 in.)
— A.M. pistons (2nd solution)	
Grade A	99.822 to 99.834 mm. (3.9300 to 3.9304 in.)
Grade B	99.834 to 99.846 mm. (3.9304 to 3.9309 in.)
— P.M. pistons (3rd solution)	99.828 to 99.840 mm. (3.9302 to 3.9307 in.)
Standard diameter at the base of the skirt and on the main axis, applicable to:—	
— A.M. pistons (1st solution)	99.886 to 99.910 mm. (3.9325 to 3.9335 in.)
— A.M. pistons (2nd solution)	99.874 to 99.898 mm. (3.9320 to 3.9329 in.)
— P.M. pistons (3rd solution)	99.880 to 99.892 mm. (3.9322 to 3.9327 in.)
Spare piston oversize range	.02 - .04 - .06 - .08 mm. (.008 - .016 - .024 - .032 in.)
P.M. piston working clearance at 50 mm. (1.97 in.) from the skirt base	.160 to .190 mm. (.0063 to .0075 in.)
— Wear allowance (A.M. and P.M. pistons)	.30 mm. (.0118 in.)
Ring side clearance:—	
— 1st compression ring	.090 to .122 mm. (.0035 to .0048 in.)
Wear allowance	.50 mm. (.020 in.)
— 2nd oil control ring	.050 to .082 mm. (.0020 to .0032 in.)
— 3rd oil scraper ring	.040 to .072 mm. (.0016 to .0028 in.)
2nd and 3rd ring wear allowance	.20 mm. (.008 in.)
Ring gap:—	
— 1st compression ring	.35 to .55 mm. (.0138 to .0216 in.)
— 2nd oil control ring	.30 to .45 mm. (.0118 to .0177 in.)
— 3rd oil scraper ring	.25 to .40 mm. (.0098 to .0157 in.)
Maximum wear gap	1.00 mm. (.040 in.)
Gudgeon pin clearance in pistons	.003 to .017 mm. (.0001 to .0006 in.)
Spare gudgeon pin oversize	.20 mm. (.008 in.)
Gudgeon pin bore machining oversize in piston	.20 mm. (.008 in.)
Connecting Rods	
Gudgeon working clearance in small-end (see Fig. 29)	.014 to .029 mm. (.005 to .0011 in.)
— Wear allowance	.06 mm. (.0024 in.)
Small-end bush interference fit	.063 to .140 mm. (.0025 to .0055 in.)
Small-end bush bore dia. machining oversize	.20 mm. (.008 in.)
Flyweight-type Dynamic Balancer (605 C)	
Intermediate gear running clearance (19, Fig. 32) (2)	.050 to .100 mm. (.0020 to .0040 in.)
Flyweight drive gear shaft running clearance (2)	.050 to .100 mm. (.0020 to .0040 in.)
Drive gear shaft running clearance (2)	.050 to .100 mm. (.0020 to .0040 in.)
Sleeve spline tooth backlash	.028 to .106 mm. (.0011 to .0042 in.)
Flyweight drive gear shaft end running clearance	.013 to .061 mm. (.0005 to .0024 in.)
Flyweight pin working clearance	.020 to .073 mm. (.0008 to .0029 in.)
Bush interference fit	.040 to .100 mm. (.0016 to .0040 in.)
Idler gear running clearance (3)	.013 to .061 mm. (.0005 to .0024 in.)
Gear tooth backlash	.080 mm. (.0031 in.)

(2) Bush interference fit .063 to .140 mm. (.0025 to .0055 in.)
(3) Bush interference fit .037 to .101 mm. (.0014 to .0040 in.)

CRANKSHAFT

Withdraw the belt pulley hub using tool Part No. **291504** to take out the crankshaft.

Wash the shaft and inspect carefully. Even the slightest cracks necessitate crankshaft renewal.

Check both main journals and crankpins:—

— Pick-up or scratch marks can be remedied by means of zero grade emery cloth.

— Score marks, ovality or taper in excess of .050 mm. (.002 in.) necessitate journal skimming to the nearest oversize dimension (see Data Table).

After re-grinding, blend the journal fillets and round lubricating hole edges as shown in Fig. 22.

Subsequently, check the crankshaft noting that:—

— Ovality of the journals should not exceed .008 mm. (.0004 in.).

— Taper of each journal should be lower than .012 mm. (.0005 in.).

— Maximum misalignment with the shaft over V-blocks should be .05 mm. (.002 in.) (see D, Fig. 23).

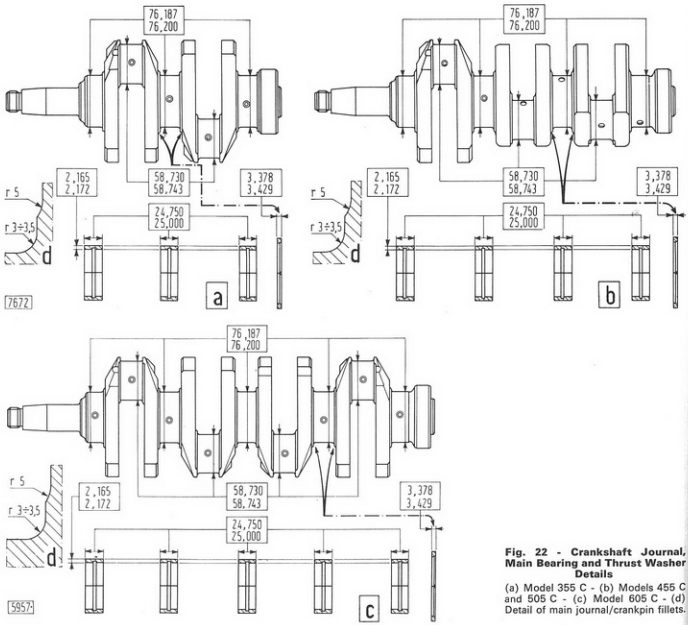


Fig. 22 - Crankshaft Journal, Main Bearing and Thrust Washer Details

(a) Model 355 C - (b) Models 455 C and 505 C - (c) Model 605 C - (d) Detail of main journal/crankpin fillets.

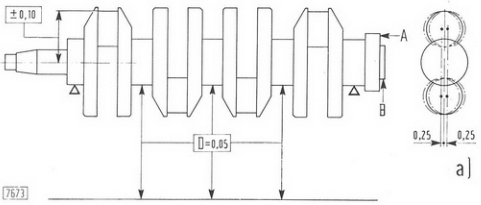


Fig. 23 - Checking Main Journal and Crankpin Alignment
(a) Detail of maximum misalignment of crakpins with respect to the main journals - A and B. Flange run-out stylus position - D. Maximum main journal misalignment.

— Maximum misalignment of each pair of crankpins (or of the two crankpins in the 2-cylinder engine) with respect to the main journals should not exceed ± .25 mm. (± .010 in.) (see Fig. 23).

— The allowance on the distance from top of crankpin to crankshaft rotational axis should not exceed ± .10 mm. (± .004 in.) (see Fig. 23).

— Run-out, as measured with the dial gauge stylus in (A) at the periphery of the crankshaft flange, should not exceed .02 mm. (.0008 in.). Moreover, eccentricity in (B) should not exceed .04 mm. (.0016 in.).

Check the core plugs for leakage with oil at 15 kg/cm² (213 p.s.i.). To renew the core plugs, press fit, peen in position and re-check for oil leaks.

Following crankshaft refitting and main bearing cap re-tightening check the end float at the last bearing cap but one (see Fig. 24). If excessive play is detected fit oversize thrust washers (3).

CRANKSHAFT FRONT AND REAR SEALS

Oil tighteness at the front end of the crankshaft is obtained through two metal-reinforced double-lip rubber seals featuring a coil spring and fitted in timing gear case cover (5, Fig. 25, a) and in a suitable carrier (9, b) respectively.

Check the seal face for wear, coil spring for failure and lip for damage.

To renew the seal:—

— Wipe off all traces of oil and dry the seal seat thoroughly.

— Soak the seal in engine oil for 30 min. Subsequently, fit the seal applying a uniform pressure over the entire seal ring, using a drift so that the seal will bed-in correctly.

— Lubricate the lips with a film of thick oil and pack the cavity with grease to prevent the seal from being damaged during initial running owing to lack of lubricant.

MAIN/BIG-END BEARINGS AND CAPS

The bearing caps are numbered for correct refitting. The reference marks should line up as illustrated in Fig. 24.

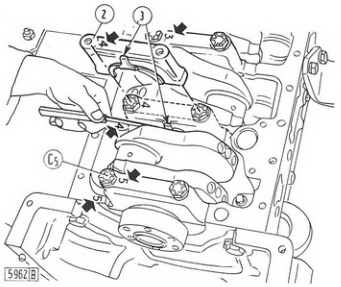


Fig. 24 - Checking the Crankshaft End Float
(Arrows point to reference numbers, which should line up on refitting bearing caps) - C_5. Bearing cap self-locking screws - 2. Bearing cap - 3. Thrust washers.

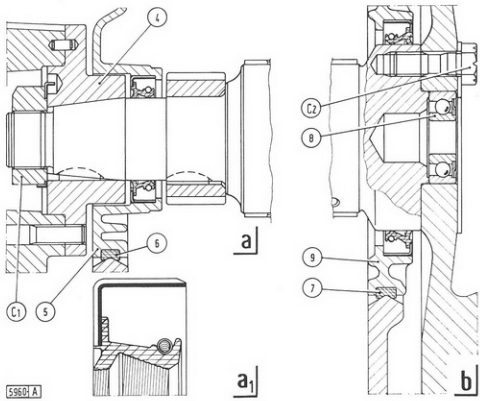


Fig. 25 - Sectional Views of Crankshaft Front and Rear Seals (a and b respectively)

a_1. Detail of crankshaft seal - C_1. Retaining nut - C_2. Flywheel self-locking screws - 4. Pulley hub - 5. Timing cover - 6 and 7. Sump split seals - 8. Clutch/P.T.O. shaft bearing - 9. Rear seal seat carrier.

The bearings should be renewed whenever their working surfaces are found to be scored or worn.

The bearing running clearance with respect to the crankshaft can be checked using Perfect Circle Plastigage calibrated wire (see Fig. 26), as follows:—

— Place a length of calibrated wire over the bearing.

— Fit the bearing cap and tighten.

— Remove the cap and compare the width of the compressed calibrated wire with the reference scale printed on the wire container.

Perform the same check on big end bearings.

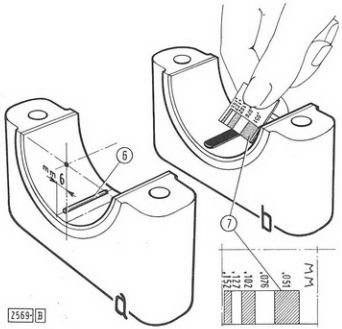


Fig. 26 - Checking Crankshaft Journal Running Clearance

a. Calibrated wire in position on main bearing cap - b. Comparing width of compressed calibrated wire with reference scale - 6. Calibrated wire - 7. Graduated scale printed on wire container.

PISTONS AND RINGS

A.M. standard size pistons (1st and 2nd solution - see Data Table) are selected, according to the measure taken at 50 mm. (2 in.) from the skirt base, into two dimensional grades A and B.
P.M. standard size pistons (3rd solution) are not graded.

When renewing the pistons, note the following points:—

— A.M. pistons (1st and 2nd solution) are interchangeable provided the same grade is retained; moreover, they should be matched with A.M. liners of the same grade.

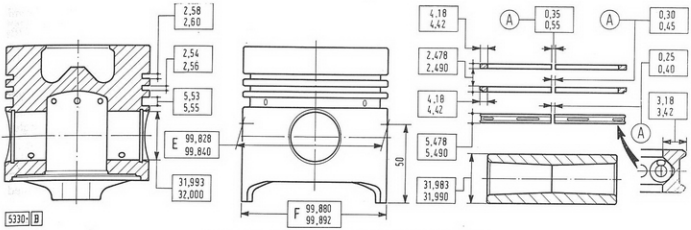


Fig. 27 - Standard Piston, Pin and Ring Details

A. Fitted ring gap - E. P.M. piston diameter, as measured at 50 mm. (2 in.) from skirt base (See Data Table for A.M. pistons) - F. Maximum P.M. piston diameter, as measured at the skirt base (See Data Table for A.M. pistons).

— P.M. pistons can be fitted in replacement of A.M. pistons of both grades, consequently, they can be fitted to A.M. liners regardless of grade.

— A.M. pistons of the second solution, as far as grade A is concerned, can also be fitted to P.M. liners.

The grade, if any, and the weight are stamped on the piston crown.

Clean the pistons by scraping off all combustion deposits and wash with petrol, paraffin or solvent.

Assess piston and liner wear as shown in Figs. 27, 28 and 8. If the clearance is found to be in excess of .30 mm. (.012 in.), rebore the liners and fit oversize pistons and rings (see Data Table).

Should it become necessary to renew the pistons, make sure the weight of new pistons is within a tolerance of 10 grams (.36 oz).

Fit the piston rings (compression ring and oil control rings) using pliers Part No. **291159**.

Check that piston ring side clearance (see b, Fig. 28) and gap (see c) are as prescribed (see Data Table). Renew as necessary.

Should the gap be smaller than prescribed, grind the ends. When refitting the pistons, make sure that ring ends are staggered at 180° from each other (see b, Fig. 31).

CONNECTING RODS

Check that big end bearings are tight and flush with big end sides.

Check bearing inner faces for seizing or score marks; if score marks are detected ream using expansion reamer or tool Part No. **290280** placed on a standard centre lathe.

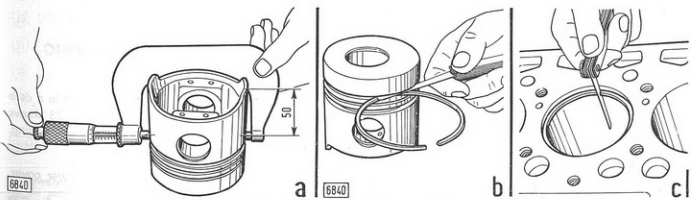


Fig. 28 - Checking the Piston and Rings

a. Checking piston diameter at 50 mm. (2 in.) from skirt base - b. Checking piston ring side clearance - c. Checking piston ring cap.

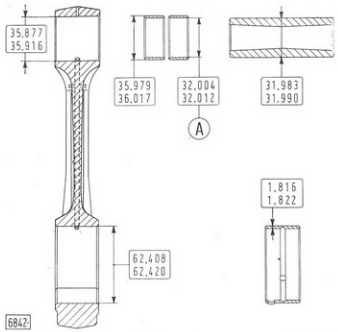


Fig. 29 - Connecting Rod, Big End Bearing, Small End Bush and Standard Gudgeon Pin Details
A. Fitted dimension after reaming.

Subsequently, make sure that the gudgeon pin running clearance is not in excess of .06 mm. (.0024 in.), otherwise open out up to .2 mm. (.0078 in.) oversize and fit oversize pin.
Should .2 mm. (.0078 in.) oversize is not sufficient, renew the bearings.
To check connecting rod alignment use gauge Part No. **292172** (see Fig. 30); maximum misalignment between big and small end axes should not exceed .05 mm. (.010 in.) in any direction when measured 125 mm. (5 in.) away from the rod centreline. Any slight distortion may be remedied using a suitable press.
In case of connecting rod replacement, ensure that the new rods are selected to obtain a maximum weight difference of 10 grams (.36 oz).
Also make sure that piston and liner lubricating holes (H and I, Fig. 30) are free from scales.

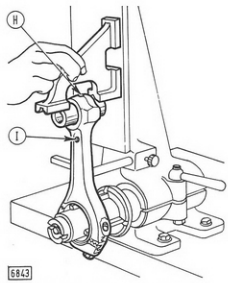


Fig. 30 - Checking Connecting Rod Alignment
H. Piston crown lubricating hole - I. Liner lubricating hole.

Note : Whenever the connecting rods are dismantled renew the cap retaining screws.

TO REFIT CONNECTING ROD/PISTON ASSEMBLIES

Refit rods and pistons so that the connecting rod identification number corresponds to the number of the associated cylinder and is located on the same side of the marks (FIAT trade mark, weight, dimensional class) stamped on the top of the piston (see b, Fig. 31).
Check squareness using gauge Part No. **292172** (see a). Refit the piston with attached ring and rods into the associated liners using sleeve Part No. **291048**. Make sure that the identification numbers are on the side opposite the camshaft (V).
After refitting, at T.D.C. pistons should protrude .46 to .79 mm. (.018 to .031 in.) from block top surface.

FLYWHEEL

The flywheel is secured to the crankshaft in a particular fitting position to prevent incorrect reassembly.
When renewing bearing (8, Fig. 25), fit the dust seal facing the clutch and pack the associated housing with grassofiat G 9 or other approved grease.

FLYWEIGHT TYPE DYNAMIC BALANCER (605 C)

The flywheight type dynamic balancer is housed in a case bolted to the inside of the engine sump. Fig. 33 shows the schematics of the dynamic balancer. When removing, note the following points:—

— Drain engine sump oil and remove the lower cover.

— Take off oil pump scoop, retaining screws (C_8, Fig. 32) and take out the weight assemblies.

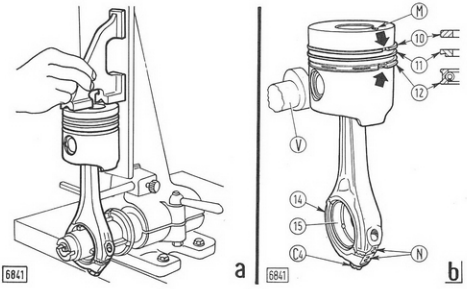


Fig. 31 - Checking Piston/Connecting Rod Squareness (a) and fitted position with respect to Camshaft (b)

(The arrows point to the ring gaps which should be staggered at 180° to one another).

C_1. Cap retaining screws - M. Stamp location (trade mark, weight, dimensional class) - N. Reference number of corresponding cylinder - V. Camshaft - 10. Compression ring - 11. Oil control ring - 12. Oil scraper -14. Cap - 15. Big end bearing.

— If necessary, remove lubricating pipe (24), retaining screws (9), drive gears (18) and flange (16).

To dismantle the weight assembly proceed as follows:—

— Withdraw spring pins (25, Fig. 34) and weight carriers using a drift.

— Remove flange retaining screws (7), snap ring (30) and flyweight drive gear (30).

— Remove snap ring (36) and idler gear (34).

Check for wear, renew any defective parts, ream the new bushes using expansion blade reamers Part Nos. **290001** and **291242**.

To fit the new bushes, pre-heat the weights in oil at 140° to 160 °C. (284° to 320 °F).

On refitting the parts, make sure that weight drive gear (11, Fig. 34) and weights (27) are positioned so that all reference marks are lined up, as arrowed in Fig. 35.

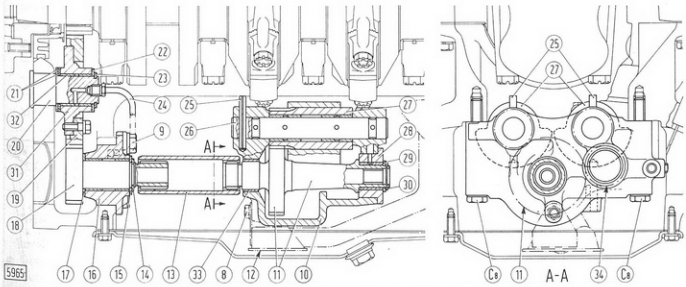


Fig. 32 - Sectional View of Flyweight Type Dynamic Balancer

C_2. Flyweight case retaining screws - 8. Oil scoop retaining screws - 9. Flange retaining screws - 10. Case - 11. Flyweight drive gear - 12. Oil scoop - 13. Sleeve - 14. Snap ring - 15. Thrust washer - 16. Drive gear flange - 17. Thrust washer - 18. Drive gears - 19. Intermediate gear - 20. Intermediate gear carrier - 21 and 22. Thrust washers - 23 Snap ring - 24. Lubricating pipelet - 25. Spring pin - 26. Flyweight carrier - 27. Flyweights - 28. Flyweight drive gear flange - 29. Thrust washer - 30. Snap ring - 31. Intermediate gear flange - 32 and 33. Bushes - 34. Idler gear.

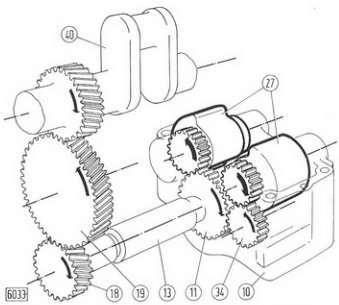


Fig. 33 - Layout of the Flyweight Type Dynamic Balancer
10. Case - 11. Flyweight drive gear - 13. Sleeve - 18. Drive gears - 19. Intermediate gear - 27. Flyweights - 34. Idler gear - 40. Crankshaft.

Moreover, note that:—

— Idler gear (34, Fig. 34) should be positioned with the longer end oriented towards the case wall.

— Split pin holes in weight carriers (26) should be aligned with those in the case.

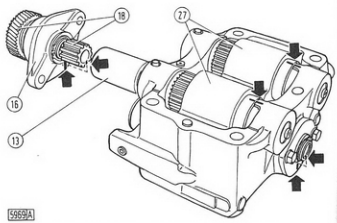


Fig. 35 - Timing the Dynamic Balancer
13. Sleeve - 16. Flange - 18. Drive gears - 27. Flyweights.

On refitting the flyweights, time the gears as follows:—

— Bring cylinder No. 1 to T.D.C.

— Secure drive gear (18, Fig. 32) to the sump, with the reference marks aligned as shown in Fig. 36.

— Lock the weights in position with pin (39) and check reference mark alignment.

— Place sleeve (13) in position and tighten the retaining screws to the specified torque.

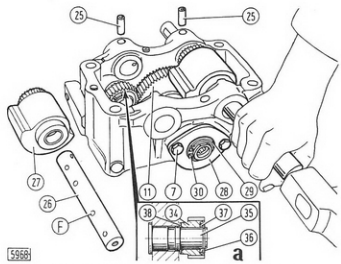


Fig. 34 - Withdrawing Flyweight Carriers
a. Sectional view of idler gear - F. Lubricating holes - 7. Flange retaining screws - 11. Flyweight drive gear - 25. Spring pins - 26. Flyweight carrier - 27. Flyweight - 28. Flange - 29. Thrust washer - 30. Snap ring - 35. Idler gear carrier - 36. Snap ring - 37 and 38. Thrust washers.

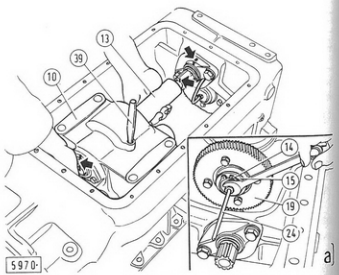


Fig. 36 - Refitting the Dynamic Balancer
(The arrows point to the timing reference marks).
a. Refitting the lubrication pipelet - 10. Flyweight case - 13. Sleeve - 14. Snap ring - 15. Thrust washer - 19. Intermediate gear - 39. Positioning pin.

FUEL SYSTEM

FUEL SYSTEM DATA

Model 355 C	
Lift Pump	Piston type, injection pump camshaft-driven
Pump output, 1.2 to 1.5 kg/cm² (17 to 21 p.s.i.):—	
— At 500 r.p.m.	.78 litres/min. (1.37 Pints/min.)
— At 1000 r.p.m.	1.35 litres/min. (2.30 Pints/min.)
FIAT/BOSCH Injection Pump	In-line, L.H. helix plungers
Type	PES 2 A 80 B 410 : L4/110
Direction of rotation (drive end)	Clockwise
Firing order	1 (180 deg.) - 2 (540 deg.)
Camshaft end float	.02 to .06 mm. (.0008 to .0024 in.)
Camshaft shim thickness range (see Fig. 50)	.10, .12, .14, .16 and .18 mm. (.0040, .0048, .0056, .0064 and .0072 in.)
Mechanical Governor (Kiki)	Centrifugal flyweight type NP-EP/RSV 200-1250
Flyweight shims (S_1, Fig. 47)	.2 and .3 mm. (.008 and .012 in.)
Automatic Advance Device	Centrifugal flyweight type FIAT, PAV 6° 500 - 1100 ARD 16
Maximum advance at governed speed	6 deg. (to injection pump camshaft)
Spring shim thickness range	.15, .20 and .50 mm. (.006, .008 and .020 in.)
Outer spring length:—	
— Free	39.5 to 40.5 mm. (1.555 to 1.594 in.)
— Under 7.25 to 7.75 kg. (15.9 to 17 lb.)	31.5 mm. (1.240 in.)
— Under 21.6 to 23 kg. (47 to 51 lb.)	25.5 mm. (1.004 in.)
Inner spring length:—	
— Free	23.9 to 25.9 mm. (.941 to 1.019 in.)
— Under 3.59 to 4.39 kg. (7.9 to 9.7 lb.)	24.4 mm. (.961 in.)
— Under 21.2 to 22.6 kg. (46 to 49 lb.)	19.9 mm. (.783 in.)
Injection Pump Drive	
Inner washer thickness (see 78, Fig. 46)	1.45 to 1.50 mm. (.057 to .059 in.)
Outer washer thickness (76)	2.93 to 3.00 mm. (.115 to .118 in.)
Hub O.D. (74)	49.975 to 50.000 mm. (1.9675 to 1.9685 in.)
Bush fitted I.D. (59)	50.050 to 50.075 mm. (1.9705 to 1.9715 in.)
Hub running clearance in bushes	.050 to .100 mm. (.002 to .004 in.)
Bush interference fit	.066 to .142 mm. (.003 to .006 in.)

Fuel System Data - Continued.

Models 455 C, 505 C and 605 C	
Lift Pump	Double diaphragm
Drive shaft speed	1600 r.p.m.
Pump output (min.)	100 litres/hour (22 Gall./hour)
Camshaft lobe lift (see 6, Fig. 57)	3 mm. (.120 in.)
Lift Pump Drive	
Drive shaft journal dia. (see 6, Fig. 57)	31.975 to 32.000 mm. (1.2588 to 1.2598 in.)
Bush fitted I.D. (see 7)	32.050 to 32.075 mm. (1.2618 to 1.2628 in.)
Shaft running clearance	.050 to .100 mm. (.002 to .004 in.)
Bush interference fit	.063 to .140 mm. (.002 to .005 in.)
Inner washer thickness (see 8)	1.45 to 1.50 mm. (.057 to .059 in.)
Outer washer thickness (see 9)	2.93 to 3.00 mm. (.115 to .118 in.)
Injection Pumps	Distributor type with integral governor
Pump make:—	
— Model 455 C	
— Bosch	EP/VA3/110 H - 1200 CL 134-4
— C.A.V.	DPA 3233410
— Model 505 C	
— C.A.V.	DPA 3233420
— Model 605 C	
— Bosch	EP/VA4/110 H - 1100 CL 136-1
— C.A.V.	DPA 3249460
Direction of rotation (drive end)	Anti-clockwise
Firing order:—	
— Models 455 C and 505 C	1-2-3
— Model 605 C	1-3-4-2
FUEL INJECTORS	Four-orifice nozzles
FIAT nozzle type:—	
— Model 355 C	DLL 145 S 50 F
— Models 455 C, 505 C and 605 C	DLL 145 S 60 F
FIAT injector body type	KB 70 S 1 F 10
Release pressure	225 to 235 kg/cm² (3,200 to 3,343 p.s.i.)
Spring data (see 4, Fig. 84):—	
— Free length	27 to 27.5 mm. (1.063 to 1.083 in.)
— Deflection from 16,1 to 41.8 kg. (24 to 92 lb.)	.8 mm. (.032 in.)

AIR CLEANER

To ensure sustained engine efficiency the air cleaner should be cleaned at regular intervals.
Check the oil level in the bowl; this is particularly important in dry climates. The correct level is up to the rib (6a and 6b, Fig. 37).

Renew the oil whenever it is found to be contaminated or if the sediment is ½ in. deep (10 mm.).
Every 200 hours, remove element (4a, 4b), empty the oil, and wash in paraffin, together with bowl and centre pipe.
Prior to removing the element it may be necessary to take off a retaining ring. Refill with fresh oil.
Every 400 hours, clean the entire unit by dipping in

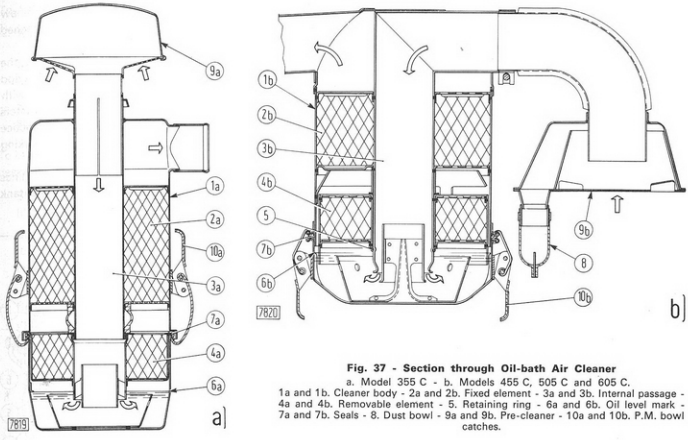


Fig. 37 - Section through Oil-bath Air Cleaner
a. Model 355 C - b. Models 455 C, 505 C and 605 C.
1a and 1b. Cleaner body - 2a and 2b. Fixed element - 3a and 3b. Internal passage - 4a and 4b. Removable element - 5. Retaining ring - 6a and 6b. Oil level mark - 7a and 7b. Seals - 8. Dust bowl - 9a and 9b. Pre-cleaner - 10a and 10b. P.M. bowl catches.

paraffin for thirty minutes; blow dry using compressed air, rebuild the filter and refill up to the correct oil level. Check the pre-cleaner and inlet manifold pipe clips for looseness, to prevent unfiltered air from being drawn into the system.

FUEL TANK

The fuel tank should be thoroughly cleaned whenever the tractor is overhauled. Occasionally, drain the condensate and sediment by removing the plug screwed in the bottom of the tank. This operation should be carried out when the tank is almost empty, and more frequently if the tractor is used in damp or cold climates, and in areas subject to sharp temperature changes.

Check that the vent hole in the filler cap is not obstructed. Models 455 C, 505 C and 605 C are provided with a dashboard-mounted fuel gauge the needle of which is electrically moved over a red sector on the dial when the reserve of fuel is down to less than 15 litres or $3^1/_4$ Gall.

FUEL FILTER (355 C)

Every 50 hours, drain the condensate accumulated in the bowl (1, Fig. 38). To do this, back off the drain plug through a few turns.

Every 200 hours, clean the bowl in paraffin and renew the paper cartridge (2) with attached seals.

On completion of filter servicing, bleed as follows:—

— Open the fuel tank valve, back off bleed screw (3, Fig. 38), crank the engine with the starter until the

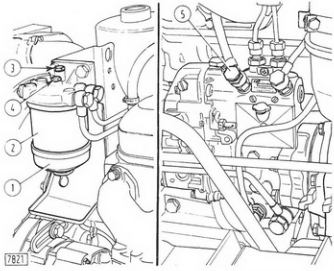


Fig. 38 - Bleeding the Fuel System (Model 355 C)
1. Bowl with condensate drain plug - 2. Filter cartridge - 3. Bleed screw - 4. Filter retaining screw - 5. Injection pump drain pipe retaining screw with attached bleed screw.

fuel issuing from the hole below the bleed screw is free from air bubbles. Retighten the screw.

— Back off screw (5) on the injection pump drain fitting and proceed as described above.

FUEL FILTERS (455 C - 505 C - 605 C)

Every 50 hours, discharge the condensate from bowl (1, Fig. 39) on the first filter. To do this back off the bowl screw by a few turns.

Every 200 hours, clean the bowl in paraffin and renew paper cartridge (2) on the first filter, together with attached seals.

Every 800 working hours, renew the cartridge on the second filter (6). Note that during the warranty period this filter is sealed and should not be tampered with by unauthorised persons. The cartridges of the two filters should not be renewed simultaneously. Normal practice is for the second filter to be changed 40 to 50 working hours after the first filter.

On completion of fuel filter servicing, bleed the lines ensuring that the fuel tank is not empty and the tank valve is open.

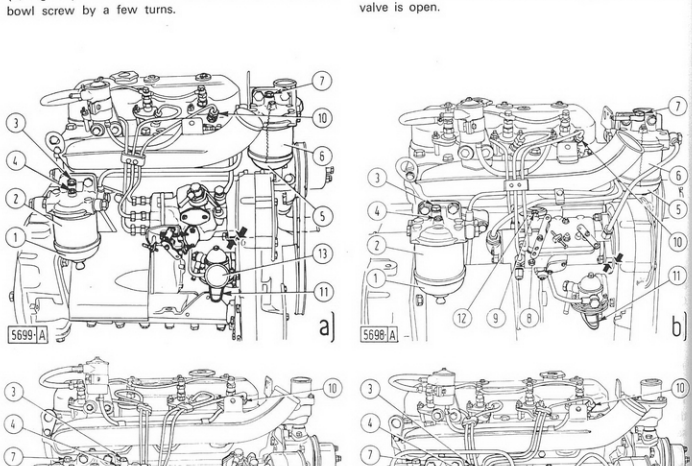


Fig. 39 - Bleeding the Fuel System

a. Model 455 C, Bosch pump - b. Model 505 C, C.A.V. pump - c. Model 605 C, Bosch pump - d. Model 605 C, C.A.V. pump. (Arrows indicate external timing marks).

1. Bowl, first filter, with condensate drain screw - 2. Cartridge, first filter - 3. Bleed screw, first filter - 4. Retaining screw - 5. Bowl, second filter (no drain screw) - 6. Cartridge, second filter - 7. Bleed screw, second filter - 9. C.A.V. hydraulic head vent screw - 9. C.A.V. governor vent screw - 10. Injector connectors - 11. Priming pump manual control - 12. Transfer pressure damper (3-cylinder engine, C.A.V. injection pump) - 13. Inlet pressure damper (Bosch injection pump).

To bleed the Bosch fuel system, proceed as follows:—

— Back off bleed screw (3, Fig. 39) on the first filter and actuate priming control (11) until the fuel issuing from the bleed orifice in the screw is free from air bubbles. Retighten screw (11).

— Repeat the above procedure on screw (7) of the second filter.

To bleed the C.A.V. fuel system, perform the two operations described above, plus the following:—

— Slacken vent screw (8) on the hydraulic head and bleed as described for the filters.

— Back off governor vent screw (9) through two turns, fully slacken injector connectors (10) and crank the engine with the starter until the fuel issuing from the lines is free from air bubbles.

— Retighten the injector connectors.

— Start the engine, check that the fuel issuing from governor vent screw (9) is free from air bubbles, and ritighten.

FUEL LIFT PUMP (355 C)

The piston type fuel lift pump if fitted below the injection pump and is driven off the injection pump through a cam and tappet mechanism.

Up to engine No. 228698, lift pumps incorporate a priming pump, whereas from engine No. 228699 onwards, the priming pump has been suppressed (priming and bleeding being performed by cranking the engine through the starter).

During overhaul, check for:—

— Inlet and outlet valve inefficiency (see 3 and 4, Fig. 40).

— Leakage past the piston (2).

If the valves and the piston are in good condition, priming of the dry pump on the test machine at 200 R.P.M. should take approximately 30 seconds.

At 500 to 600 R.P.M., the lift pump outlet pressure should be 1.5 kg/cm² (21 P.S.I.). If this reading is not obtained, it could be that the piston return spring is weakened.

Finally, the pump output should be checked for compliance with the values specified in the Data Table.

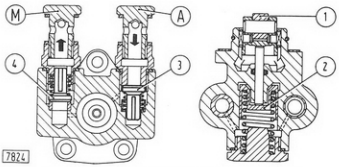


Fig. 40 - Sections through P.M. lift pump
A. Inlet connector - M. Outlet connector - 1. Actuating tappet - 2. Piston - 3. Inlet valve - 4. Outlet valve.

FUEL LIFT PUMP (455 C - 505 C - 605 C)

The double-diaphragm fuel lift pump (see Fig. 41) is actuated by a gear-driven camshaft (see Fig. 57) and incorporates inlet and outlet valves.

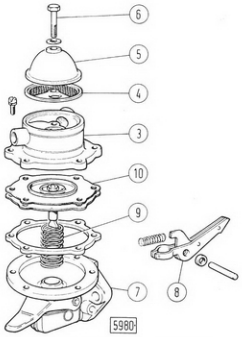


Fig. 41 - Exploded View of Lift Pump
3. Upper pump body incorporating inlet and outlet valves - 4. Gauze filter/seal - 5. Cover - 6. Cover retaining screw - 7. Lower pump body - 8. Actuating lever - 9. Diaphragm return spring - 10. Diaphragm with attached actuating link.

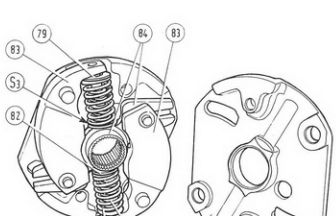


Fig. 42 - Automatic Advance Device with Cover Removed
S_3. Spring pre-load shims - 78. Cover - 79. Spring plate - 80. Outer spring - 81. Inner spring - 82. Spring plate - 83. Flyweight - 84. Slotted link with hub.

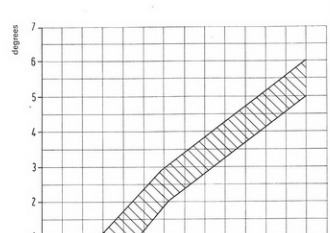


Fig. 44 - Advance Device Operating Curves
(The angular variations should fall within the shaded tolerance band).

During overhaul, check that the valves and the gauze filter are not obstructed, and that the double diaphragm is not torn.

For new or reconditioned pump data see page 35.

The Bosch fuel system incorporates an inlet pressure damper (13, Fig. 39) fitted to the lift pump, to counter the effect of pressure surging.

AUTOMATIC ADVANCE DEVICE (355 C)

Drive to the pump is transmitted through gear (74, Fig. 46), advance device (77), drive sleeve (73) and serrated bush (42).

The advance device has two centrifugal flyweights (83,

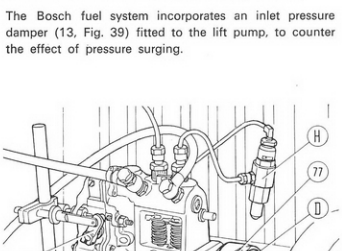


Fig. 43 - Testing the Advance Device with the Stroboscope
A. Holding bracket No. 290984 - D. Advance device driver plate No. 290771 connected to test machine coupling - H. Tell-tale injector - 8. Throttle lever - 77. Advance device.

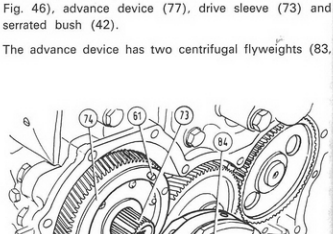


Fig. 45 - Refitting the Advance Device to the Engine
(The arrows indicate the machined-off tooth on the drive bush and the corresponding unmachined space width in slotted link). 73. Serrated drive sleeve - 74. Injection pump drive gear - 61. Dowel - 84. Slotted link hub.

Fig. 42) opposed by two pairs of control springs which alter the angular position of the slotted link (84) keyed to the drive sleeve (73, Fig. 46), in response to variations in rotational speed.

Advance device efficiency, i.e. the aplitude of the angular movement of the hub relative to the body, can be checked on the injection pump test machine using driver plate (D, Fig. 43) and the stroboscope.

If a tell-tale injector (H) is used to detect the angle of advance, remember that its range of application is from 800 to 1,000 R.P.M.

Check that the angle displacement, as evidenced by the movement of the light spot, falls within the tolerance band indicated in Fig. 44. If the results obtained are unsatisfactory, dismantle the advance device and alter the thickness of spring pre-load shims (S_3, Fig. 42), or renew the springs as necessary.

Shim thickness range is .15, .20 and .50 mm (.006, .008 and .020 in.).

During overhaul, ensure that the flywheights pivot freely. If the slotted link runners and guide pins are worn, renew without hesitation.

Note : When fitting new flyweights check that they are of the correct weight, as identified by numerals or colour paint marks. Maximum weight tolerance is 10 grammes ($^1/_3$ ounce).

The advance springs should meet the requirements of the Data Table.

On reassembly, ensure that the reference marks on cover and body are in register.

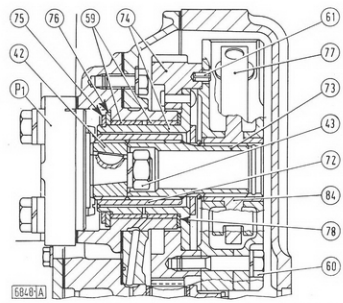


Fig. 46 - Section through Advance Device and Injection Pump Drive

P_1. Injection pump - 42. Drive bush - 43. Retaining nut - 59. Drive gear bushes - 60. Retaining screw - 61. Dowel - 72 Drive sleeve - 73. Drive sleeve (welded to sleeve 72). - 74. Drive gear assembly. - 75. Circlip. - 76. Outer thrust washer - 77. Advance device - 78. Inner thrust washer. - 84. Slotted link hub.

FIAT INJECTION PUMP (355 C)

The in-line fuel injection unit fitted to tractor model 355 C has two pump elements and incorporates an all-speed mechanical governor.

TO OVERHAUL THE GOVERNOR

Governor operation is illustrated in Fig. 55. For overhaul, use the special tools prescribed.

On reassembly, check the distance from thrust sleeve (62, Fig. 47) to governor body (24) with gasket (65) removed.

The difference between actual dimension (X) and prescribed dimension (Y) gives the value of shim thickness (S_1).

This check can be made with the flyweights fully in, in which case the value of the prescribed dimension (Y) is 19.8 to 20.2 mm. (.779 to .795 in.), or with the flyweights fully out, for which the prescribed dimension is 29.8 to 30.2 mm (1.173 to 1.189 in.).

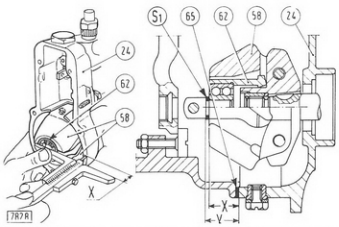


Fig. 47 - Checking Thrust Sleeve Position Relative to the Governor Body

X. Thrust sleeve-to-governor body measured distance - Y. Thrust sleeve-to-governor body correct clearance (including shims) - 58. Flyweights - 65. Gasket - S_1. Shims.

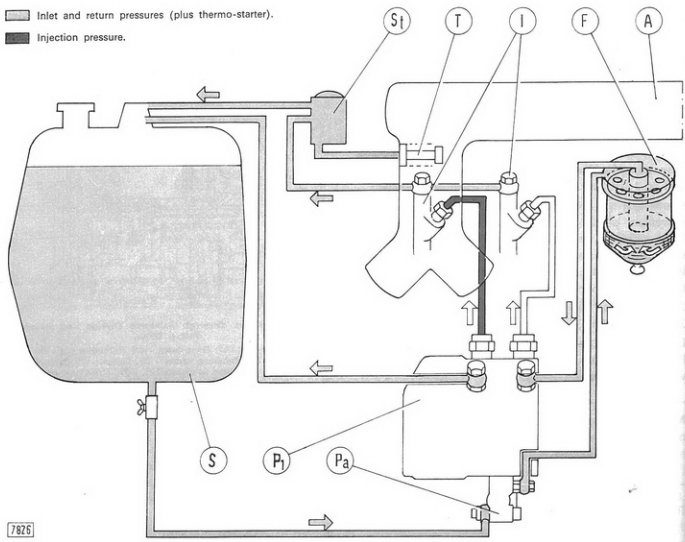


Fig. 48 - Fuel System Diagram - Model 355 C

A. Inlet manifold - F. Fuel filter - I. Fuel injectors - Pa. Lift pump - P_1. Injection pump - S. Fuel tank - St. Thermo-starter reservoir - T. Thermo-starter (optional).

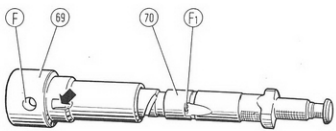


Fig. 49 - Correct Reassembly Position of Pump Element

(Guide pin slot arrowed)

F. Fuel inlet port - F_1. Back-leak orifice - 69. Barrel - 70. Plunger.

TO OVERHAUL THE INJECTION PUMP

The use of rotary stand No. **290239** fitted with plate No. **290312** facilitates injection pump overhaul considerably.

For dismantling and reassembly, use the special tools listed in the appropriate section.

To Adjust the Camshaft Bearings

Position the tapered roller bearings (56, Fig. 50) on to the camshaft, together with rear spacer (31), front spacer (32) and a pack of shims (s) sufficient to obtain a clearance (L) between bearing cap (30) and pump body (see a).

Retighten bearing cap retaining screws (V_2) progressively in diagonal sequence, simultaneously turning the camshaft by hand, to take up the clearance without preloading the bearings. The correct end float is .02 to .06 mm. (.0008 to .0024 in.).

Assess clearance (L) by taking four readings at peripheral points 90 degrees apart. Subsequently, find the arithmetical average of the readings obtained.

Total shim thickness (S_2 + S_3) will be obtained by subtracting the value of clearance (L) from initial shim pack thickness (S).

Divide the total shim thickness into equal parts S_2 and S_3 (see b) noting that if the available range of shims is such that it cannot be divided into two packs of equal thickness, the maximum allowance is .2 mm (.008 in.).

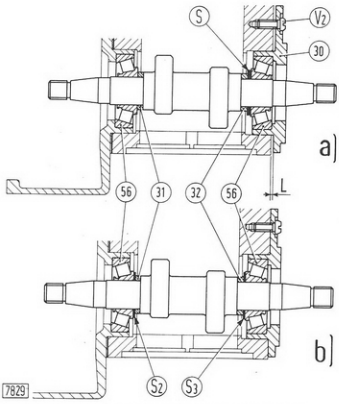


Fig. 50 - Adjusting the Camshaft Bearings

L. Camshaft clearance - S. Shim pack for determining camshaft clearance - S_2. Rear shims - S_3. Front shims - V_2. Retaining screws - 30. Front bearing cap - 31. Spacer (thickness 2 mm. or .08 in.) - 32. Spacer (thickness 2 mm. or .08 in.) - 56. Tapered roller bearings.

TO TEST AND CALIBRATE THE FIAT INJECTION PUMP (355 C)

Place the pump on the test machine (see Fig. 51), seal the lift pump aperture using the cover plate provided, fit the drive coupling and establish the fuel inlet and outlet connections, using the special tools designed for the purpose and Diesel fuel or FIAT calibrating fuel B.

1. To Check Control Rod Stroke

Control rod stroke from shut-off (rod fully towards the governor) to maximum fuel position should be 11.9 to 12.1 mm. (.468 to .476 in.), as measured with a depth gauge. Check that at maximum fuel position the delivery is as prescribed in the Calibration Data Table. To adjust, turn the toothed quadrants as necessary.

2. To Check Plunger Stroke and Adjust Toothed Quadrants

Prior to starting the tester motor, ensure that:—

— The reference marks stamped on the plunger lugs face towards the operator.

— In top-of-stroke position, each plunger clears the delivery valve by at least .2 mm. (.008 in.). To adjust, turn tappet nuts (4, Fig. 55).

Also check that the toothed quadrant lug position is the same for both elements.

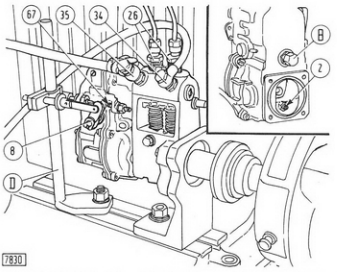


Fig. 51 - Injection Pump in Position on the Test Machine

B. Idling damper - D. Holding bracket No. 290984 - 2. Maximum fuel adjusting screw - 8. Throttle lever - 26. Delivery connectors - 34. Fuel inlet connection - 35. Relief valve and return connection - 67. Maximum speed adjusting screw.

3. Delivery Connector Leakage Test

Check delivery connector tightening torque (4.5 to 5 kgm or 32 to 36 lb.ft.).

Plug the fuel inlet connection, fit plugs of kit No. **291195** to delivery connectors (26, Fig. 51), remove the relief valve from the fuel return connection and connect to hand pump No. **290284**.

At 75 to 100 kg/cm² (1,067 to 1,422 p.s.i.) there should be no leakage.

4. Delivery Valve Leakage Test

Connect the delivery connector of the valve in question to the hand pump No. **290284** and apply a 400 kg/cm² (5,690 p.s.i.) pressure.

The pressure should take over 3 minutes to fall to 300 kg/cm² (4,267 p.s.i.). If necessary, renew the valve assembly.

5. Feed Pressure Test

Connect the test machine inlet and return lines to the pump, and install the relief valve in the return connection.

Feed the pump and check that the tester reading is 1.2 to 1.5 kg/cm² (17 to 21 p.s.i.). If necessary, adjust the relief valve.

6. To Check and Adjust Spill Cut-off

Remove the delivery connector, spring and valve from the pump element under test and replace with connector **A. 65024 (292174)** and dial gauge **A. 95667 (290314)**.

Move throttle lever to full throttle position, bring the plunger to bottom-of-stroke position, zero the dial gauge and feed fuel, simultaneously turning the pump clockwise by hand.

When fuel ceases to flow take a dial gauge reading. The stroke to spill cut-off should be 2.15 to 2.25 mm. (.085 to .089 in.).

If necessary, adjust the tappet using the specified tools.

Check the point of spill cut-off (commencement of delivery) on the other pump element adopting the foregoing procedure or using a stroboscope in conjunction with the test machine dial.

7. To Adjust the Governor

Fully tighten spring pre-load adjusting screw (20, Fig. 55) and back off by 20 clicks.

Back off spring screw (6a) to de-activate the idling damper.

Move throttle lever (8, Fig. 51) to full throttle position and adjust stop screw (67) until the control rod begins to be pulled back at 1250 to 1260 r.p.m.

8. Pump Plunger Leakage Test

Set the accelerator lever to full throttle position and compare delivery variation (spread) between injectors at 200 r.p.m. (minimum test machine speed) versus spread at 1240 to 1250 r.p.m. (maximum engine speed at full load). Spread should not exceed 25 to 30%.

In this connection remember that:—

— Pump elements resulting in more than 30% spread must be renewed.

— Pump elements affected by 25% to 30% spread are to be renewed only if the engine reveals operating anomalies attributable to the pump elements, or it is impossible to obtain the injector delivery specified for 300 r.p.m.

Example

The arithmetical average of the three values recorded on a pump element for 500 shots with the control rod in maximum fuel position are:—

— At 200 r.p.m., 23 cm³.

— At 1240 to 1250 r.p.m., 29 cm³.

Percent spread (S) will be

$$S = \frac{29 - 23}{29} \times 100 = 20.6.$$

The pump element in question is to be considered acceptable.

Note : The above example applies to a pump fitted to a Rabotti test machine using test procedure "A".

9. To Check and Adjust Fuel Delivery

Check fuel deliveries and compare with the Data Table. To adjust, turn the control sleeve using tool No. **A. 65023 (290904)**.

Pump output at 1240 to 1250 r.p.m. can be adjusted through screw (2, Fig. 51).

FIAT INJECTION PUMP CALIBRATION DATA (355 C)

For fuel injection pump calibration use either of the following procedures.

TEST PROCEDURE A

BOSCH test machine with WSF 2044/4X injector spring and EFEP 182 spray nozzles.
RABOTTI test machine with graduated ring nut injectors incorporating FIAT 656829 springs and EFEP 182 spray nozzles.
Pipes, 2 × 6 × 600 mm.
Release pressure, 175 kg/cm² (2,483 p.s.i.).

TEST PROCEDURE B

BOSCH or RABOTTI test machine with injector bodies and nozzles as fitted to engine.
Pipes, 2 × 6 × 600.
Release pressure, 225 to 235 kg/cm² (3,200 to 3,343 p.s.i.).

CALIBRATION FLUID

Diesel oil or FIAT CFB.
Density, 830 ± 10 grammes/litre at 40° ± 3 °C.
Feed pressure, 1.2 to 1.5 kg/cm² (17 to 21 p.s.i.).

FIAT/BOSCH IN-LINE INJECTION PUMP TYPE PES 2 A 80 B 410 : L4/110 - 769482

Throttle Lever Position	Speed r.p.m.	Control Rod Stroke	PROCEDURE A		PROCEDURE B	
			Injector Delivery	Pump Output	Injector Delivery	Pump Output
			cm³/1,000 shots		cm³/1,000 shots	
Idling	300^{-10}_{+0}	9.5 ± 0.5	10 ± 1	—	10 ± 1	—
Maximum	1250^{-10}_{+0} (1)	12 ± 0.1	55 ± 1	110 ± 1.5(2)	51,5 ± 1	103±1.5 (2)
Excess fuel	75	—	100 or over	—	100 or over	—

(1) Governor cut-in speed 1250 to 1260 r.p.m.
(2) Adjust maximum fuel screw (2, Fig. 51)

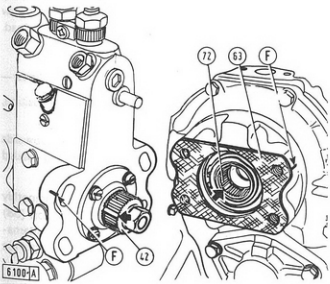


Fig. 52 - Refitting the Injection Pump to the Engine
(The arrows indicate the machined-off tooth on the drive bush and the unmachined space width to be meshed).
F. Timing reference marks. - 42. Serrated drive bush - 63. Gasket - 72. Pump drive sleeve.

FIAT INJECTION PUMP REFITTING AND TIMING

Refit the injection pump to the engine adhering to the following instructions:—

— Smear gasket (63, Fig. 52) with jointing compound and reposition over the mounting face.

— Offer up the pump ensuring that the machined-off tooth on drive bush (42) meshes with the unmachined space width on drive sleeve (72), turn the pump body until the external timing marks (F) are in register and refit and retighten the retaining screws.

If the above operations are carried out correctly, the pump is thus timed with respect to the engine.
However, where pump inefficiency is suspected, carry out an overflow check as follows:—

— Remove the delivery connector on pump element No. 1 (26a, Fig. 53), and remove the delivery valve, spring and restrictor. Refit the delivery connector.

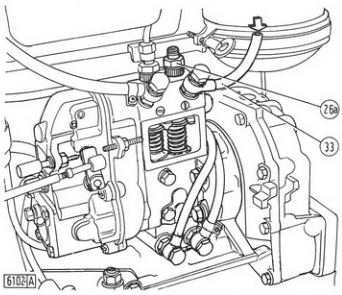


Fig. 53 - Checking Injection Pump Timing by the Overflow Procedure

26a. Delivery connector of pump element No. 1 - 33. Fuel inlet connection.

— Set the accelerator control lever to the full-throttle position and feed the P.M. pump using connecting pipe (33). The use of this pipe is dictated by the absence of the priming pump. Bleed the injection pump body.

— Remove the pump tappet cover and slowly turn the crankshaft clockwise until pump element No. 1 is in bottom-of-stroke position, when the engine piston should be at the beginning of the compression stroke.

— Continue to pump fuel and turn the crankshaft until fuel flow through connector (26a) ceases. The fuel level should remain up to the brim of the connector. This condition corresponds to the commencement of delivery to engine cylinder No. 1, when the external timing pointer should register with the mark INIEZ stamped on the flywheel.

In case of misalignment, slacken the injection pump retaining screws and turn the pump body as necessary until correct timing mark alignment is obtained.

Rescribe the external timing marks on pump flange and engine block to facilitate subsequent pump timing.

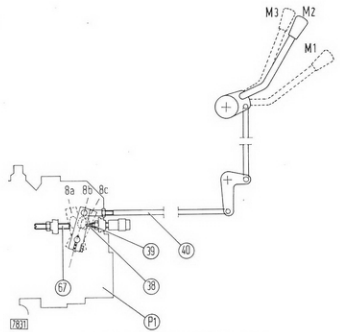


Fig. 54 - The Throttle Linkage

M_1. Accelerator control lever in maximum speed position. - M_2. Accelerator lever in idling position - M_3. Accelerator lever in shut-off position - P_1. Injection pump - 8a. Throttle actuating lever in maximum speed position - 8b. Throttle lever in idling position - 8c. Throttle lever in shut-off position - 38. Spring-loaded idling stop - 39. Shut-off stop screw - 40. Adjustable link - 67. Maximum speed adjusting screw.

TO CHECK AND ADJUST THROTTLE LINKAGE AND ENGINE IDLING SURGE

Fig. 54 shows accelerator control lever positions for maximum speed (8a), idling (8b) and shut-off (8c).

Maximum speed position (8a) is controlled by screw (67) which is adjusted on the test machine (see page 44, test No. 7). Therefore, it will suffice to move the manual accelerator lever to the maximum fuel position (i.e. fully down) and check that throttle lever (8a) abuts screw (67) and link (40) deflects slightly sideways under load.

If necessary, adjust link length.

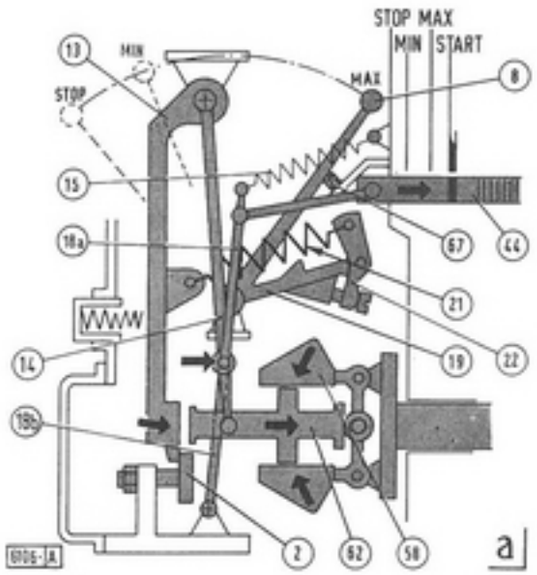
To check and adjust engine idling proceed as follows:—

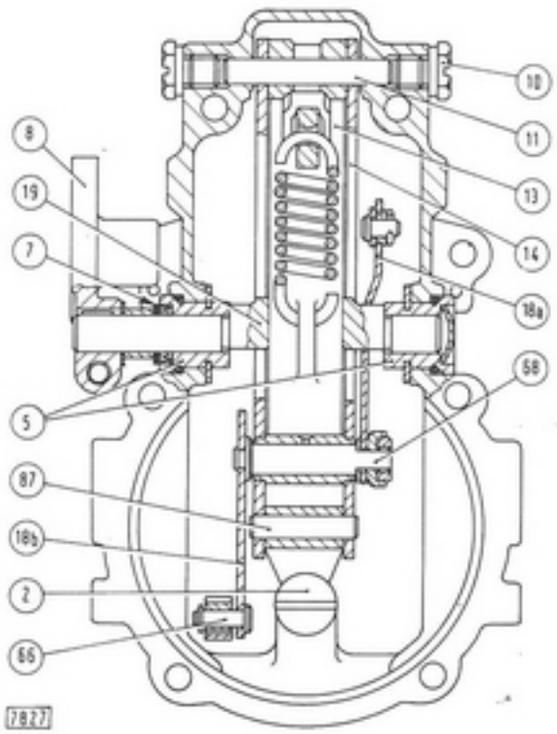
— Bring the accelerator lever to maximum speed position, start the engine and allow to warm up.

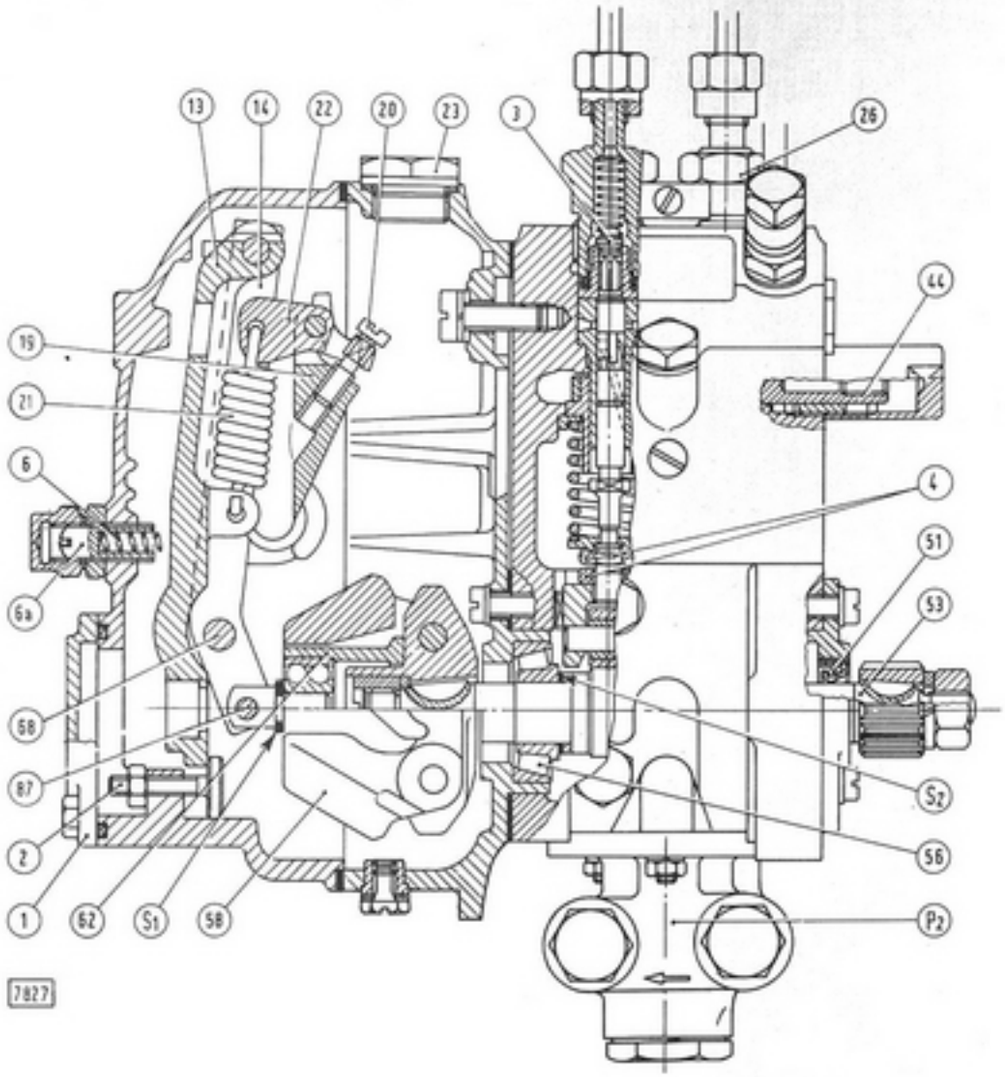
— Slowly move accelerator lever (M_2, Fig. 54) upwards until the throttle lever begins to depress spring-loaded idling stop (38).

In these conditions the engine should idle fairly smoothly at 600 to 650 R.P.M. If necessary, adjust idling stop (38) and damper spring adjusting screw (6a, Fig. 55) alternately. Remember that to reduce idling speed surge the damper spring screw must be screwed in.

To check engine shut-off move the accelerator lever upward to position (M_3, Fig. 54), when the throttle lever should depress idling stop (38) fully and contact stop screw (39) to shut down the engine.







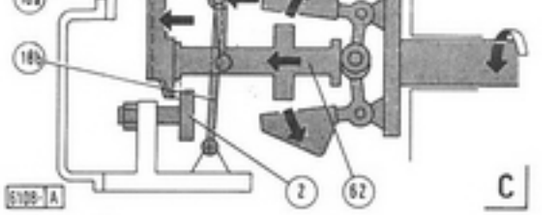


Fig. 55 - Sections through FIAT In-line Fuel Injection Pump, and Governor Operation Diagram

P_2. Lift pump - S_1. Flyweight shims - S_2. Rear camshaft bearing shims - 1. Access cover - 2. Full-load adjusting screw - 3. Delivery valve - 4. Tappet adjustment nut - 5. Bushes - 6. Idling damper spring - 6a. Idling damper adjusting screw - 7. Throttle lever shims - 8. Throttle lever - 10. End plugs - 11. Fulcrum pin - 13. Governor link - 14. Control arm - 15. Excess fuel spring - 18a. Control rod link - 18b. Fulcrum lever - 19. Rocking lever - 20. Rocker adjusting screw - 21. Governor spring - 22. Rocker - 23. Access plug - 26. Delivery connector - 44. Control rod - 51. Seal - 53. Pump camshaft - 56. Tapered roller bearing - 58. Governor weights - 62. Thrust sleeve - 66. Fulcrum pin - 67. Maximum speed adjusting screw - 68. Pivot pin - 87. Connecting pin.

a. Engine starting

With the engine stationary and throttle lever (8) in any position, governor weights (58) are fully closed and, owing to the force of spring (15), thrust sleeve (62) is held inwards (in the direction of the arrow) while control rod (44) is held in excess fuel position (START) by link (18a). The load of spring (21) causing link (13) to press against screw (2) depends on the position of throttle lever (8). In the diagram, the arrows indicate the static load springs (15 and 21) impose on the mechanism when the engine is stationary.

As soon as the engine is running engine speed increases quickly, weights (58) tend to open out and move thrust sleeve (62) to contact link (13) and move control rod (44), to reduce fuelling through control arm (14), control rod link (18a) and fulcrum lever (18b).

When centrifugal force overcomes the load of spring (21) acting on link (13), thrust sleeve (62) causes control rod (44) to move further back, thereby reducing fuelling until the engine stabilises at the selected speed.

b. Speed selection

To increase engine speed throttle lever (8) is moved towards the maximum speed position (MAX), thereby increasing the load of spring (21). To reduce engine speed the throttle lever is moved to the idling position (MIN). When the throttle lever is moved to idling position governor spring load diminishes considerably, thereby allowing the flyweights to open out to bring the control rod to the minimum fuel position (MIN) as shown by the arrows. Thus, idling damper spring (6) contacts governor link (13), thereby helping to control link oscillation and minimise engine idling surge.

When throttle lever (8) is moved to position "STOP" a further reduction in governor spring load occurs, the flyweights open out a little more and the control rod takes up the no-fuel position (STOP) to shut down the engine.

c. Operation under load

When the selected speed has been reached, governor action maintains it within close limits up to the corresponding maximum load, regardless of load variation. If the engine speed tends to increase owing to a reduction in load, the flyweights move outwards, thrust sleeve (62) overcomes the opposition of governor spring (21) acting on link (13) and control rod (44) moves to reduce fuelling and restore the selected speed. A fall in engine speed due to increased load causes the flyweights to move inwards and the engine speed increases in response to increased fuelling. Maximum load is controlled through screw (2) which stops link (13) and thrust sleeve (62), causing control rod (44) to be held in maximum fuel position (MAX).

Finally, ensure that the no-load maximum speed of the engine (governed speed) does not exceed 2,700 R.P.M.

To adjust, back off damper screw (6a, Fig. 55) as necessary.

BOSCH INJECTION PUMP (455 C - 605 C)

The Bosch fuel injection equipment (see Fig. 56) incorporates the following (see Fig. 58):—

— Vane type transfer pump (P_1) with integral regulating valve (V_1) supplying a gradually higher pressure with increasing rotational speed.

— Hydraulic head (A), comprising pumping and distributing rotor (51) for fuel delivery to the injectors, and the control gear, whose operation diagram is given in Fig. 64.

— Automatic advance variator (B, Fig. 58), controlled by fuel pressure from the transfer pump.

— Bleed and check valve (V_2), providing a continuous exhaust to tank for cooling and lubrication purposes.

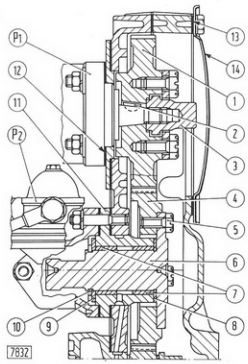
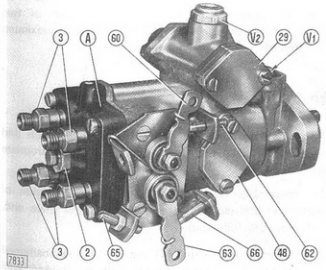


Fig. 57 - Section through Injection and Lift Pump Drive
P_1. Bosch or C.A.V. injection pump drive end - P_2. Diaphragm lift pump - 1. Injection pump drive gear - 2. Woodruff key - 3. Retaining nut - 4. Lift pump drive gear - 5. Retaining screw - 6. Lift pump camshaft - 7. Bushes - 8. Inner thrust washer - 9. Outer thrust washer - 10. Circlip - 11. Carrier - 12. Gasket - 13. Gasket - 14. Access cover.



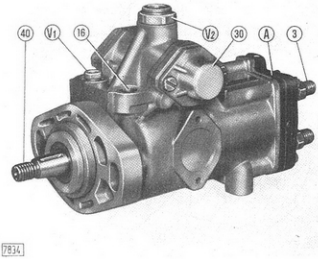


Fig. 56 - The Bosch Fuel Injection Pump for Four-cylinder Engines
A. Hydraulic head - V_1. Pressure regulating valve - V_2. Bleed and check valve - 2. Centre plug with bleed screw - 3. Delivery connectors - 16. Fuel inlet port - 29. Advance piston access cover, pressure side - 30. Advance piston access cover, spring side - 40. Pump drive shaft (direction of rotation, anti-clockwise) - 48. Pump timing cover - 60. Maximum fuel and shut-off control lever - 62. Maximum fuel adjusting screw - 63. Throttle lever - 65. Maximum speed adjustment screw - 66. Idling speed adjustment screw.

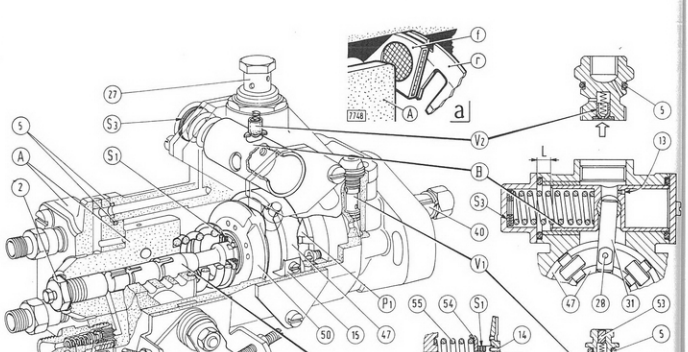


Fig. 58 - Section through Bosch Injection Pump Assembly

a. Ring filter (f) and spring washer (r) inserted between pump body and hydraulic head (P.M.).
A. Hydraulic head - B. Advance variator piston - L. Advance variator piston stroke - P_1. Transfer pump - S_1. Rotor spring pre-lo shim - S_2. Spill cut-off shim - S_3. Advance variator spring pre-load shims - V_1. Pressure regulating valve - V_2. Bleed and check valve 2. Centre plug - 5. O-ring - 13. Fuel pressure feed to advance piston - 14. Rotor drive peg - 15. Timing pointer - 27. Return connector 28. Advance lever retaining pin - 31. Advance lever - 40. Pump drive shaft - 47. Roller carrier - 50. Cam plate - 51. Rotor - 52. Regu lating valve plunger retainer - 53. Regulating valve adjusting screw - 54. Spring cup - 55. Rotor spring - 63. Throttle lever - 92. Deliver valve.

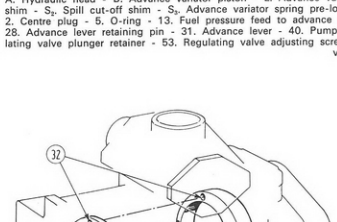


Fig. 59 - Transfer Pump Cam Ring in Assembled Position

(Arrows indicate point of thickest wall section to face towards pump cover).

32. Hole in cam ring and thrust ring to face towards advance unit - 40. Drive shaft - 41. Cam ring - 42. Transfer pump rotor - 45. Thrust ring - 46. Abutment ring.

Injection pump control is effected by means of tw levers, namely throttle lever (63, Fig. 56) and maximu fuel and shut-off lever (60, Fig. 56).

TO OVERHAUL

Place the injection pump assembly on the bench an prepare the necessary tools listed in the appropriat section.

On reassembly, remember that the pump direction o rotation is anti-clockwise, as seen from the drive end and note the following:—

— Transfer pump cam ring (41, Fig. 59) is to be position with hole (32) at the top and with the thickest wa thickness (arrowed) facing the timing cover.

— Cam plate (50, Fig. 58) is to be refitted with drivin peg (14) in alignment with the drive shaft end ke