FiatTrattori

FIAT

450
450 DT
450 Special
450 DT Special

WORKSHOP MANUAL

QUICK-REFERENCE INDEX

D I R E Z I O N E C O M M E R C I A L E

Reprinted

FOREWORD

The manual is divided into separately numbered sections.

Two-digit sections contain:

- Tractor specification (00);
- Tractor sub-assembly specification and data (10 - Engine; 20 - Power train, etc.).

Three-digit sections deal with the overhaul of sub-assemblies whose data are listed in the two-digit section.

The first two digits are the same as those of the associated data sections (e.g. 10 - Engine, 101 - Engine block - 102 - Valve gear, etc.).

A contents list is provided to facilitate retrieval of desired information.

Each page carries the print no. of the manual and the date of issue in the bottom right hand corner of the front page.

Revised sheets will carry the same print no. followed by a digit (e.g. First revision 603.54.203/ 1 , Second revision 603.54.203/ 2 , etc.) and new issue date.

Revised sheets will be accompanied by the updated contents sheet.

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Continued ....

GENERAL: Contents

/Continued

SHIMS

When adjusting, measure each shim with a micrometer and add the values obtained. Do not rely on overall pack thickness or the nominal value indicated for each shim.

ROTARY SHAFT SEALS

To fit rotary shaft seals proceed as follows:
- Prior to fitting, soak the seals for at least half an hour in the fluid to be retained;
- Carefully clean the shaft and ensure that the contact surface is free from damage;
- Turn the end of the sealing lip towards the fluid. If of the thrower lip type, turn the grooves so that during shaft rotation the fluid tends to be thrown back;
- Smear the sealing lip with a very thin coat of lubricant (oil is better than grease) and pack the space between sealing lip and dust shield with grease (applicable to double-lip seals);
- Fit the seals into their housing using a flat ended tool or ram. Under no circumstances fit with a drift or hammer;
- Avoid entry of the seal into the recess in a tilted position. Exert a firm and uniform pressure squarely on it and ensure that the seal is pressed fully home;
- To prevent sealing lip damage during fitting, use some sort of protection before sliding over the shaft.

O-RINGS

Lubricate each ring prior to fitting and, on reassembly, slide over the part but do not twist, otherwise leakage will result.

SEALING COMPOUNDS

On the mating surfaces indicated with X or Y, apply one of the following sealing compounds: RTV SILMATE, RHODORSIL CAF 1 or LOCTITE PLASTIC GASKET.

Before applying the sealing compound, prepare the surfaces as follows:
- Using a wire brush, remove any deposits;
- Thoroughly degrease using one of the following detergents: Solvent, kerosene or hot water/soda solution.

Note - Surfaces mated previously with interposed seal are indicated with X.

BEARINGS

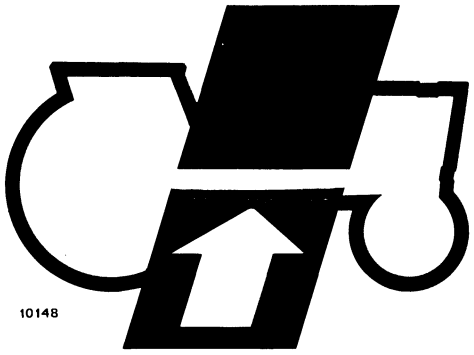
To fit bearings:
- Before installing on shafts, heat to 80° to 90°C;
- Cool before pressing them into their seats.

ROLL PINS

When fitting straight roll pin ensure that it faces in direction of work to stress the pin.
Coil roll pins can be installed in any position.

SPARE PARTS

Use exclusively FIAT spare parts, having the trade mark below.



ricambi originali
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These are the only parts that guarantee the quality, durability and safety of the original parts, being parts fitted in production.
Only FIAT spare parts can offer this guarantee.
When ordering spare parts please state:
- Tractor model (marketing code) and frame number;
- Engine type and number;
- Part number (given on "Microfiches" or "Spare Parts Catalogue).

SERVICE TOOLS

The service tools indicated in this manual are:
- Designed specifically for tractors of the Fiat range;
- Essential for reliable repair work;
- Manufactured and tested in such a way as to offer efficient and durable working instruments.

The mechanic is also reminded that being equipped means:
- Operating in optimum working conditions;
- Obtaining the best results;
- Saving time and energy;
- Working in safety.

NOTICE

Wear limits recommended for some parts are not binding, being given for guidance only.
"Front", "rear", "right" and "left" references are with operator facing normal direction of travel of tractor.

MODELS	IDENTIFICATION DATA			ENGINE Type
	Marketing		Engineering	FIAT/UTB
	on hood	on plate		
R.W.D., 6 speed	450	R450/6/1	633.900.00	8035.01.306
R.W.D., 9 speed	450	R450/9/1	633.900.00 Var.111	8035.01.306
R.W.D., 6 speed	450	R450V/6/1	633.906.00	8035.01.306
R.W.D., 9 speed	450	R450V/9/1	633.906.00 Var.111	8035.01.306
F.W.D., 6 speed	450 DT	R450 DT/6/1	633.907.00	8035.01.306
F.W.D., 9 speed	450 DT	R450 DT/9/1	633.907.00 Var.111	8035.01.306
R.W.D., 8 speed	450 SPECIAL	R450/8/1S	633.930.00	8035.01.309
R.W.D., 12 speed	450 SPECIAL	R450/12/1S	633.930.00 Var.111	8035.01.309
R.W.D., 8 speed	450 SPECIAL	R450V/8/1S	633.936.00	8035.01.309
R.W.D., 12 speed	450 SPECIAL	R450V/12/1S	633.936.00 Var.111	8035.01.309
F.W.D., 8 speed	450DT SPECIAL	R450 DT/8/1S	633.937.00	8035.01.309
F.W.D., 12 speed	450DT SPECIAL	R450 DT/12/1S	633.937.00 Var.111	8035.01.309

R.W.D. = Rear wheel drive F.W.D. = Four wheel drive

SPECIFICATION

WEIGHTS

In working order with lift, 3-point linkage, swinging drawbar and ROP frame:
- Mod. 450 ..... 1800 kg (3969 lb.)
- Mod. 450 DT .... 2100 kg (4630 lb.)
- Mod. 450 Vineyard 1650 kg (3638 lb.)

In mods. "9-12 speed" weights increase by .. 30 kg (66 lb.)

ENGINE

Direct injection, naturally aspirated 4-stroke diesel
No. of cylinders 3
Cylinder sleeves ..... Dry
Bore and stroke . 95x110mm(3.74x4.33in)
Displacement ..... 2340 c.c.
Compression ratio ..... 17 : 1
Max. horsepower DGM/DIN 48 HP(35.3 kW)
At ..... 2600 rpm
For torque speed ..... 1500 rpm
Main bearings 4
Sump ..... Iron

Valve gear

OH valves, push rod operated.

Intake
- Opens: B.T.D.C. ..... 3°
- Closes:A.B.D.C. ..... 23°

Exhaust
- Opens: B.B.D.C. ..... 48°30'
- Closes;A.T.D.C. ..... 6°

Valve clearance (timing check) 0.45 mm (0.08 in)

Valve clearance (normal):
- Intake ..... 0.25 mm (0.010in)
- Exhaust ..... 0.35 mm (0.014in)

Fuel system

Oil bath air cleaner and centrifugal automatic drain pre-cleaner.
Two in-line cartridge fuel filters; water separator integral with first filter.

Double-diaphragm cam operated fuel pump.

C.A.V. distributor injection pump:
- Type ..... DPA 3233 F 330 - 771103
- Centrifugal all-speed governor
- Hydraulic automatic advance device
- Pump timing, B.T.D.C. ..... $13^{o} \pm 1^{o}$

Four-orifice injectors:
- Type ..... See page 13, section 10
- Release pressure .... 230 ± 5 kg/cm² (225.5±4.9 bar), (3270±70 psi)

Firing order 1-2-3

Lubrication system

Forced feed, camshaft driven gear pump, integral pressure relief valve.
Oil pressure at governed speed: 3 to 4 kg/cm² (2.9 to 3.9 bar, 48 to 57 psi).
Oil filters: Strainer on pump inlet and full flow cartridge on outlet.

Cooling system

Water, centrifugal pump.
Temperature control by wax thermostat.
Four-blade steel suction fan, water pump pulley mounted.
3-deep core vertical tube radiator with copper fins, filled with anti-freeze.

Tractor meter

Incorporated on instrument panel mechanical, oil pump gear driven:
- Hourmeter activation speed..1840 rpm
- Meter drive ratio ..... 2 : 1

POWER TRAIN

Clutch

- Mod. 450: Twin, dry single plate, 10", pedal controlled.
  Plate material: organic.
- Mod. 450 SPECIAL: Twin, dry single plate, 11", separate controls: transmission clutch - pedal, P.T.O. clutch - Manual lever.
  Plate material: organic.

Transmission

- Mod. 450 : Spur gear, synchromesh on 2nd and 3rd.
  Epicyclic splitter, giving 6 forward and 2 reverse speeds.
  In version having crawler gear (in line with splitter) there are 9 forward and 3 reverse speeds.
  Separate control levers.
- Mod. 450 SPECIAL: Constant mesh, spur, synchromesh on 3rd and 4th speeds. Epicyclic splitter, giving 8 forward and 2 reverse speeds.
  In version with crawler gear (in line with splitter) there are 12 forward and 3 reverse speeds.
  Separate control levers.

Bevel drive: Straight.

Differential: Two-pinion, pedal controlled differential lock with automatic lockout.

Final drives: Spur.

(*) A further width can be obtained overturning wheels.

BRAKES

Service

Band, dry, axle shaft mounted. Controlled by two separate latched pedals.

Parking - emergency

Same components as service brakes. Parking brake lever to right of operator.

STEERING

Hourglass worm and roller. Hydraulic power assisted steering optional.
Turning radius (no brakes):

- Mod. 450 3500 mm (11ft 6in)
- Mod. 450 V 3600 mm (11ft 9in)
- Mod. 450 DT 4850 mm (15ft 11in)

FRONT AXLE

Tubular, telescoping, centre pivoting.
Track widths:

- Mod. 450 7 (*)
- Mod. 450 V 3 (*)

LIVE FRONT AXLE

Full floating, centre pivoting, fitted with 2-pinion differential and axle shafts having constant velocity U-joints (UTB axle).

Drive is transmitted from the axle drive off casing to the front axle bevel drive through a shaft with needle roller mounted U-joints.

Connection and disconnection of live front axle is through a lever located to the left of the operator.

Two track widths by overturning wheels.

REAR WHEELS

Track widths:
- Mod. 450: 1300 - 1400 - 1500 - 1600 1700 - 1800 - 1900 mm (51 - 55 - 59 - 63 - 67 - 71 - 75 in)
- Mod. 450 V: 820 - 920 - 1022 - 1122 1222 - 1322 mm (32 - 36 - 40 - 44 - 48 52 in)

FRONT AXLE DRIVE

Can be accessed by removing the rear cover from the axle case. It is used for operating belt pulley or machines requiring high speed.
- Speed: Same as engine
- Direction of rotation, tractor seen from rear : Anticlockwise.

POWER TAKE OFF (540 rpm)

- Mod. 450 : Clutch controlled by same pedal operating transmission clutch.
- Mod. 450 SPECIAL: Clutch controlled by manual lever to left of operator.

Shaft ..... 1 3/8" - 6 spline
Control ..... Manual lever
Engine speed with P.T.O. at 540 rpm ..... 2160 rpm
P.T.O. shaft speed at 2600 engine rpm .... 650 rpm
Direction of rotation (tractor seen from rear) ..... Clockwise

GROUND SPEED P.T.O.

Drive shaft and rotation the same as 540 rpm P.T.O.
Shaft drive ratio (regardless of gear engaged), with 13.6/12-28 rear tyres .. .. 3.9 revs/m of tractor travel

HYDRAULIC LIFT

Position and draft control, with adjustable response, draft control through a reaction spring connected to top link support.

Engine driven gear pump.

Rear axle oil hydraulic fluid.

Design lift capacity, maximum lift stroke and maximum lift capacity (see Section 50, page 4).

Category 1 and 2 attachment with 3-point linkage.

Lower links fitted with check chains and retaining spring.

Remote control valves (optional)

Single or double acting control valves available with two quick-connect female half inch couplings.

BELT PULLEY

Activated by tractor belt pulley drive. Can be positioned either to the left or to right depending on direction of rotation required. Controlled by P.T.O. lever.

TOWING ATTACHMENTS

Rear

- Swinging drawbar;
- Standard or Rockinger tow hook;
- Drilled cross member for application to lower links.

Front

- Rigid pull hook, not usable with front ballast.

BALLASTING

Front axle

Consists of a 100 kg (220 lb.) support to which can be applied 4 or 6 30 kg (66 lb.) plates for a total of 222 kg (490 lb.) or 282 kg (622 lb.)(1).

Rear wheels

Consists of 4 or 6 rings fastened to the wheel discs each of 55 kg (121 lb.) for a total of 237 kg (523 lb.) or 350 kg (772 lb.)

BODY

Conventional.

Centre hood with side tiltable cover.

Removable front grille.

Load-bearing wrap around fenders.

Fuel tank inside engine hood.

Anthropometric seat, padded. Parallelogram suspension, ride and reach adjustable.

9-function instrument panel plus control board.

ROP frame with roof, secured to tractor fenders.

ELECTRICAL SYSTEM (12 V)

30 A alternator, type U.T.B./U.E.P.S.-1130, with electromechanical voltage regulator type U.T.B./U.E.P.S.-1410.
3-kW starter motor type U.T.B.-2130.

Battery, fitted in front of radiator, Marelli type with capacity of 88 Ah or Scaini of 92 Ah.

A Marelli 110 Ah or Scaini 120 Ah battery is available on request.

Lighting

Two headlamps with asymmetric high and low beams (45/40 W bulb).

Two front lights including:
- Parking light (5 W bulb);
- Turn signal light (21 W bulb).

Two rear lights including:
- Parking light (5 W bulb);
- Turn signal light (21 W bulb);
- Optional: Stop light (21 W bulb);
- Number plate light (same bulb as left-hand parking light);
- Red reflectors.

Instruments and accessories

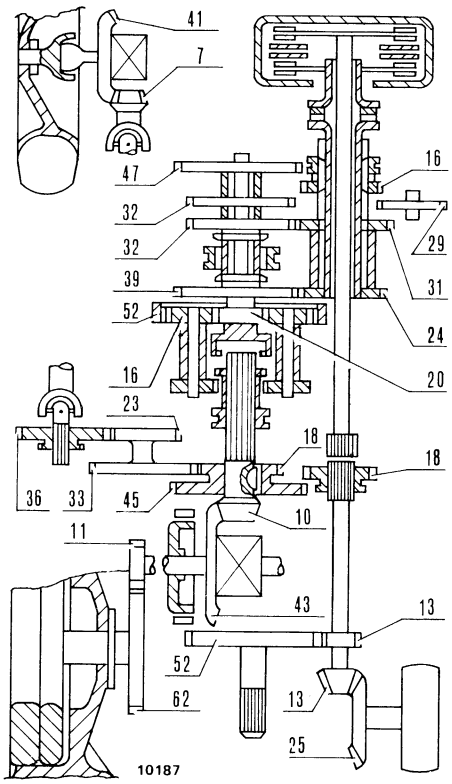
Multiple function instrument panel (see Section 60, pages 5 and 6).
Control board (see Section 60, page 6).
Starter inhibitor switch applied to transmission.
Floodlight (35 W bulb).
7-pole DIN power point.
2-pole power point.
Horn.
Cold starting device (thermostarter).
High beam indicator (blue).
Fuses : Six 8-amp and one 16-amp, located in box (see Section 60, page 4)

(1) Weights inclusive of ballasting support (100 kg, 220 lb.). In "DT" models the ballast support weights 55 kg (121 lb.) with total weights of 177 kg (390 lb.) or 237 (523 lb.) according to the number of plates installed.

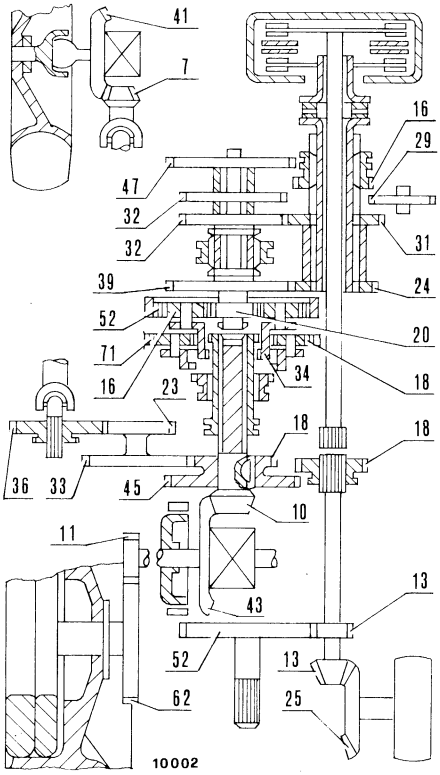
SPECIFICATION

TRANSMISSION SCHEMATICS

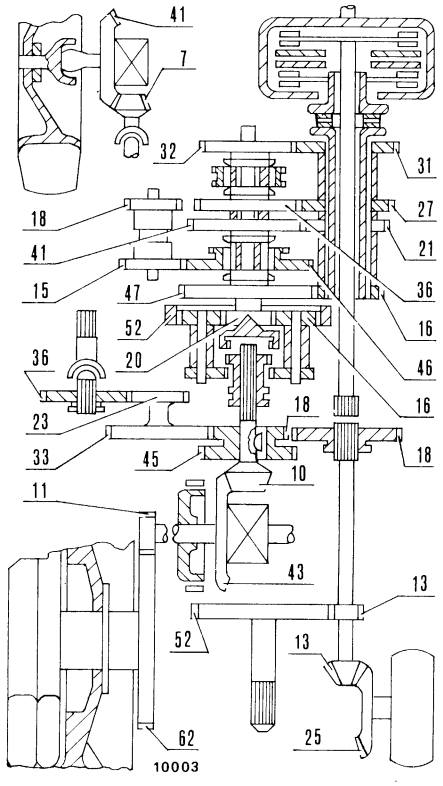
Mods. 450-450 DT/6



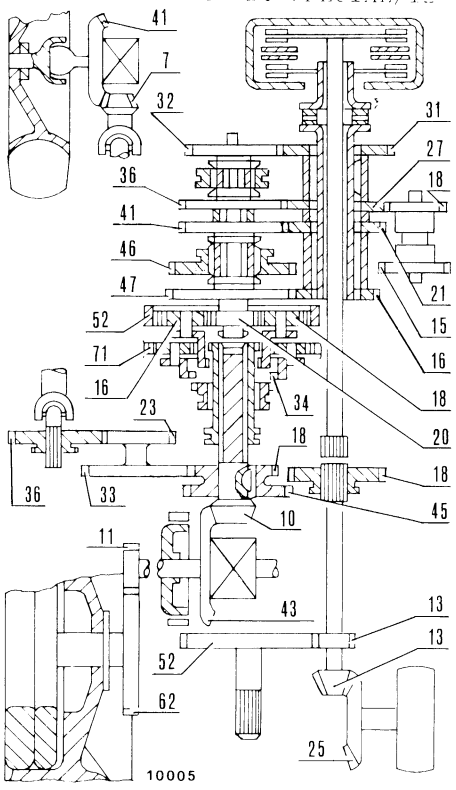
Mods. 450-450 DT/9



Mods. 450-450 DT SPECIAL/8



Mods. 450-450 DT SPECIAL/12



SPEEDS (at maximum engine speed, full load)

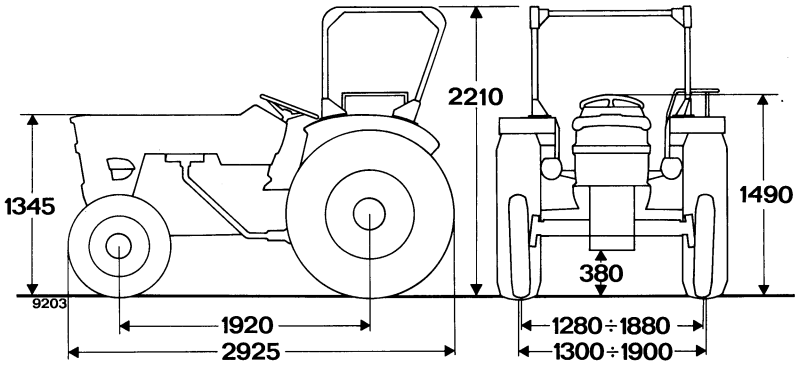
	GEARS		Rear tyres 12.4/11-28 kmh	mph	13.6/12-28 kmh	mph	14.9/13-28 12.4/11-32 kmh	mph
Mods.450"6-9 speed"	Crawler	1st.....	0.8	0.5	0.8	0.5	0.8	0.5
		2nd.....	1.3	.8	1.4	.9	1.4	.9
		3rd.....	2.1	1.3	2.2	1.4	2.2	1.4
		Reverse..	1.1	.68	1.1	.7	1.1	.7
	Low	1st.....	2.3	1.42	2.4	1.5	2.4	1.5
		2nd.....	4.1	2.5	4.3	2.6	4.4	2.7
		3rd.....	6.4	3.9	6.7	4.2	7.0	4.3
		Reverse..	3.3	2.04	3.5	2.2	3.6	2.3
	High	1st.....	8.1	5.0	8.5	5.3	8.8	5.5
		2nd.....	14.8	9.2	15.4	9.6	16.1	11.9
		3rd.....	23.1	14.3	24.1	15.0	25.2	15.7
		Reverse..	11.9	7.2	12.4	7.7	13.0	8.0
Mods.450 SPECIAL "8-12 speed"	Crawler	1st.....	0.8	0.5	0.8	0.5	0.8	0.5
		2nd.....	1.1	.7	1.1	.7	1.1	.7
		3rd.....	1.6	1.0	1.7	1.05	1.7	1.05
		4th.....	2.1	1.3	2.2	1.4	2.2	1.4
		Reverse..	1.1	.7	1.1	.7	1.1	.7
	Low	1st.....	2.3	1.4	2.4	1.5	2.4	1.5
		2nd.....	3.4	2.1	3.5	2.2	3.7	2.3
		3rd.....	5.0	3.1	5.2	3.2	5.4	3.4
		4th.....	6.4	3.9	6.7	4.2	7.0	4.3
		Reverse..	3.2	2.0	3.4	2.1	3.5	2.2
	High	1st.....	8.1	5.0	8.5	5.3	8.8	5.5
		2nd.....	12.2	7.6	12.7	7.9	13.3	8.3
		3rd.....	17.9	11.1	18.7	11.6	19.5	12.1
		4th.....	23.1	14.4	24.1	15.0	25.2	15.7
		Reverse..	11.7	7.3	12.2	7.6	12.7	7.9

TYRE SIZES

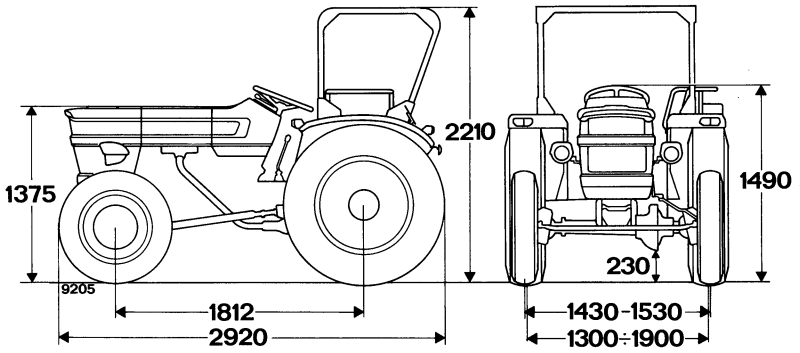
	450	450DT	450V
Front.....	6.00-16 (°) 7.50-16 (•) 6.00-19 (□)	7.50-20	5.00-15
Rear.....	12.4/11-28 (°) 13.6/12-28 (°) (•) 14.9/13-28 (•) 12.4/11.32 (□)	13.6/12-28 14.9/13-28 (*) 12.4/11-32 (*)	11.2/10-28

(°) (•) (□) Recommended tyre matching.
(*) With 720.403 variant (axle drive ratio:18/33-24/35).

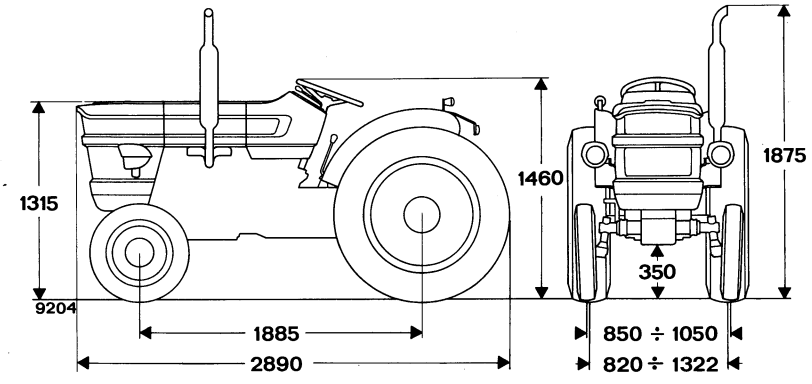
SPECIFICATION



Mod. 450 - With 6.00-16 front and 12.4/11-28 rear tyres..



Mod. 450 DT "UTB" - With 7.50-20 front and 13.6/12-28 rear tyres.



Mod. 450 V - With front 5.00-15 and rear 11.2/10-28 tyres.

CAPACITIES

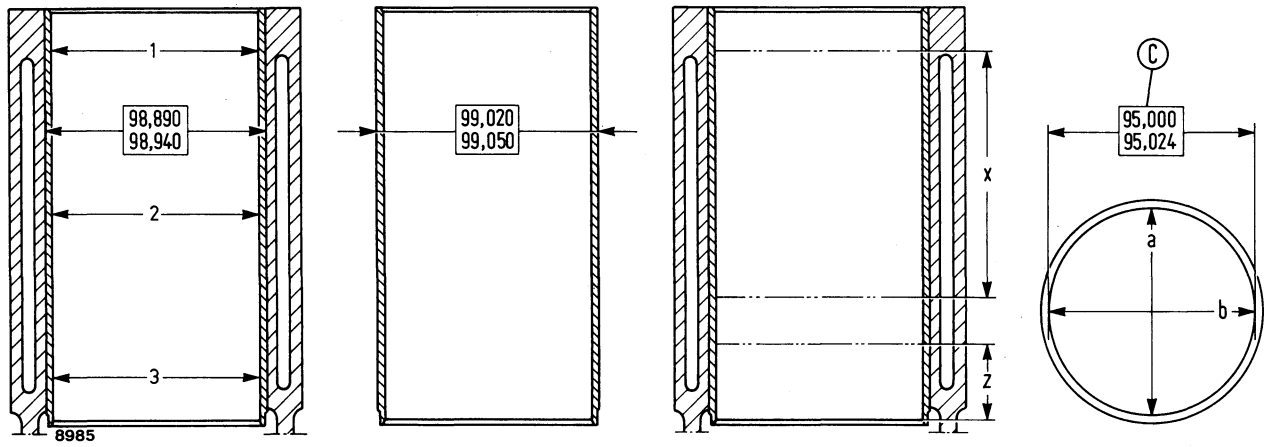
DESCRIPTION	LUBRICANTS				
	FIAT type	QUANTITY			International Designation
		Litres (dm^3)	Imp. pints	kg	
Sump, filter and lines	Oliofiat AMBRA	7.5	13	6.8	
Sump and filter	20W/40 above 0°C	6.3	11	6.6	
Sump	Oliofiat AMBRA	6.7	11 1/2	6	
Air cleaner (1)	10W/30 below 0°C	0.94	1 1/2	0.85	
Transmission, rear axle and lift:					
- Mods.450-450 Vineyard ..		17.8	30 3/4	16	Multigrade mineral oil, MIL-L-2104 B,EP characteristics
- Mod. 450 DT		22.8	40	20.5	
Steering case		0.4	3/4	0.35	
Power steering circuit	oliofiat AMBRA	2.44	4	2.2	
Final drives: 450 & 450 DT	20 W/40	1.7	3	1.5	
Final drives: 450 Vineyard		1.3	2 1/4	1.15	
Belt pulley		0.45	3/4	0.4	
"U.T.B." (SILMS) front axle:					
- Axle casing		3.3	6	3	
- U-joints (each)	grassofiat MR3	-	-	2.5	Mineral grease with lithium soap NLGI3
- Hubs (each)		-	-	0.45	
Clutch shaft bearings on flywheel		-	-	-	
Clutch withdrawal support .	grassofiat G9	-	-	0.06	Lithium-calcium based grease, NLGI2
- Lubricators				0.11	
Coolant (water + FIAT "PARAFLU" fluid) (2)			13 litres		23 pints
Fuel tank (diesel oil)			54 litres		95 pints

(1) Change cleaner oil when sediment is 1 cm. or 1/2 " deep.

(2) Fluid with anti-oxide, anti-corrosion, anti-foam and anti-scale properties. Anti-freeze property down to : -8°C, -15°C, -25°C and -35°C with "PARAFLU 11", at 20%, 30%, 40% and 50% respectively. This mixture can be kept for 2 years or 1600 working hours.

ENGINE BLOCK

		in	mm
Cylinder bore diameter in engine block		3.893 to 3.895	98.890 to 98.940
Sleeve O.D.		3.898 to 3.899	99.020 to 99.050
Sleeve interference fit in block		0.003 to 0.006	0.080 to 0.160
Sleeve diameter oversize		0.007	0.2
Sleeve bore diameter (fitted):			
- Class A		3.740 to 3.741	95.000 to 95.012
- Class B		3.741 to 3.74109	95.012 to 95.024
Maximum ovality and taper due to wear		0.005	0.12
Sleeve bore oversize		0.009 - 0.015 - 0.024 - 0.031	0.2 - 0.4 - 0.6 - 0.8
Camshaft bushing housing bore diameter	Front	2.157 to 2.158	54.780 to 54.805
	Intermediate	2.137 to 2.138	54.280 to 54.305
	Rear	2.117 to 2.118	53.780 to 53.805
Tappet housing bore diameter		0.551 to 0.552	14.000 to 14.018
Tappet oversize		0.004 - 0.009 - 0.012	0.1 - 0.2 - 0.3
Main bearing housing bore diameter		3.173 to 3.174	80.587 to 80.607



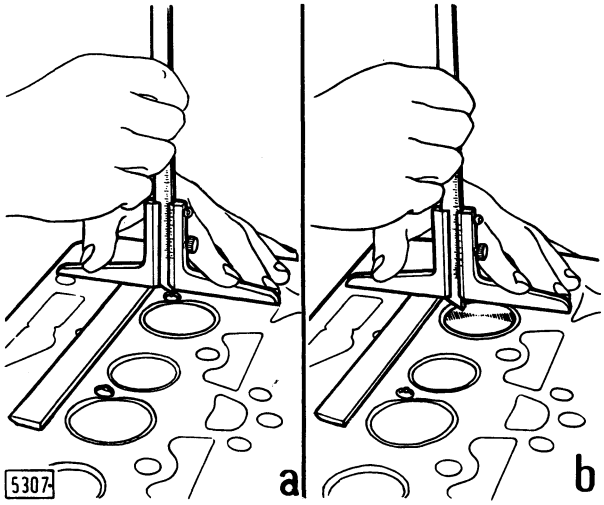
Sleeve and block inspection data

a,b. Sleeve bore measurements at right angles - C. Sleeve fitted bore diameter - Z. Sleeve wear inspection length for assessment of piston fit on plane b at right angles to crankshaft - X. Sleeve wear inspection length (swept area) for assessment of ovality and taper on planes a and b - 1,2,3. New or rebored sleeve bore measuring depth on planes a and b.

ENGINE: Specification

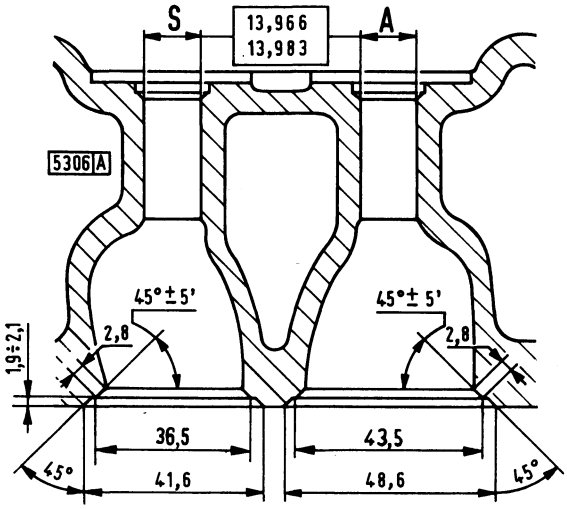
CYLINDER HEAD

	in	mm
Valve guide housing bore diameter in head	0.550 to 0.551	13.966 to 13.983
Valve guide oversize	0.008	0.2
Valve seat dimensions	See figure	
Valve depth below head face	0.028 to 0.043	0.7 to 1.1
- Maximum depth allowed	0.055	1.4
Injector protrusion from head face	0.079 to 0.098	2 to 2.5
- Maximum protrusion allowed	0.110	2.8
Cylinder head height	3.622	92
Maximum head skimming depth	0.02	0.5



Checking injector stand-out and valve stand-in

a. Protrusion : 2 to 2.5 mm (0.079 to 0.098 in) max. protrusion:2.8 mm (0.110in) - b. Valve depth: 0.7 to 1.1 mm (0.028 to 0.043 in) max. depth:1.4 mm (0.055 in).



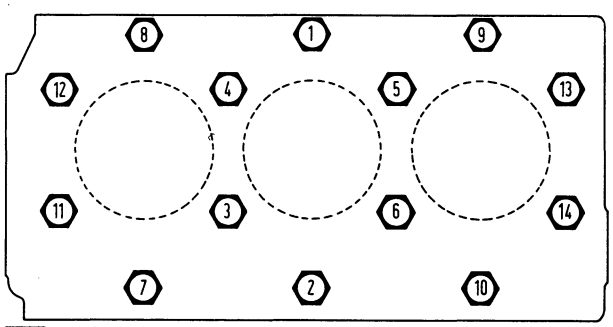
Valve seat and guide housing details

A. Intake - S. Exhaust.

Cylinder head tightening diagram

When fitting the cylinder head:

- Clean and degrease mating surfaces;
- Place the gasket (provided with adhesive base) on the block so that the mark "ALTO" contacts the head;
- Offer up the head and tighten the hold-down screws in the order shown;
- Reach torque in 3 stages as shown below:



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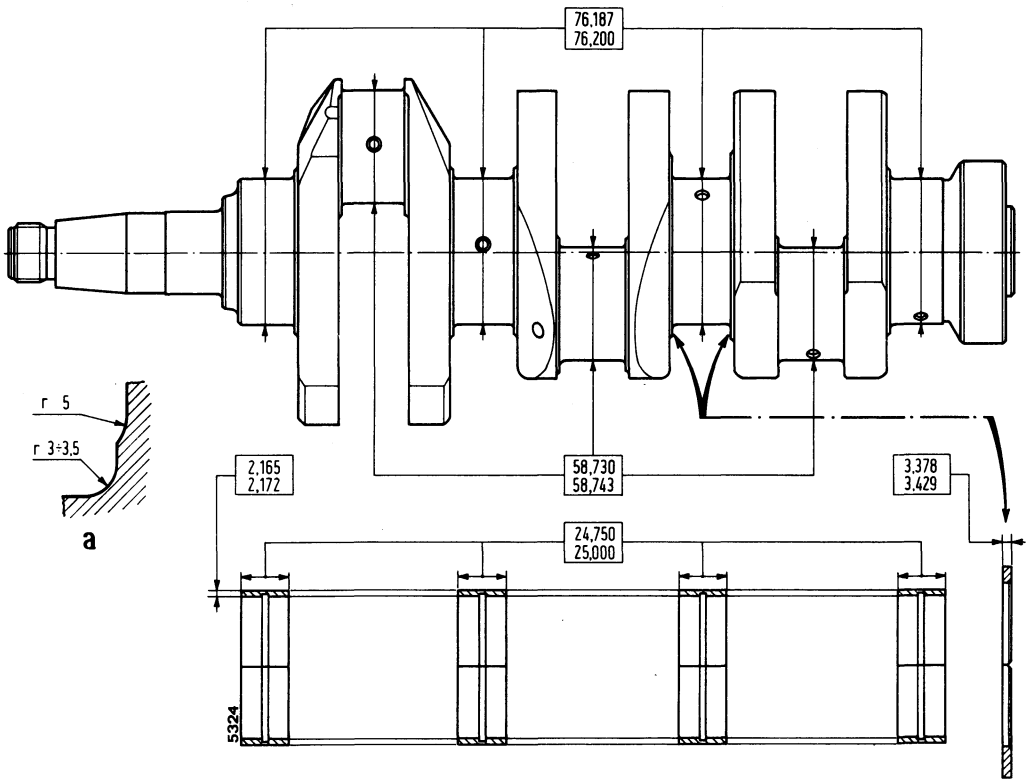
Stage	1st	2nd	3rd
kgm	4	8	12
N·m	39	78	118
Ft.lb.	30	58	87

CRANK GEAR

Crankshaft - bearings	in	mm
Main journal diameter	2.999 to 3.000	76.187 to 76.200 (1)
Main journal undersize	0.009 - 0.019 - 0.029 - 0.039	0.254 - 0.508 - 0.762 - 1.016
Main bearing wall thickness	0.085 to 0.086	2.165 to 2.172
Main bearing undersize	0.010 - 0.02 - 0.03 - 0.04	0.254 - 0.508 - 0.762 - 1.016
Main journal clearance in bearings.....	0.002 to 0.004	0.043 to 0.090
- Maximum wear clearance	0.007	0.180
Crank pin diameter	2.312 to 2.313	58.730 to 58.743 (1)
Crank pin undersize	0.010 - 0.02 - 0.03 - 0.04	0.254 - 0.508 - 0.762 - 1.016
Big end bearing wall thickness	0.071 to 0.072	1.812 to 1.822
Big end bearing undersize	0.01 - 0.02 - 0.03 - 0.04	0.254 - 0.508 - 0.762 - 1.016
Crank pin clearance in big end bearing .	0.001 to 0.003	0.021 to 0.064
- Maximum wear clearance	0.007	0.180

(1) 0.1mm (.004in) undersize crank pin and main journal crankshafts may be fitted in production coupled to corresponding undersize bearings.

Continued...



Main journal, main bearing and thrust washer details

a. Journal fillet radii detail.

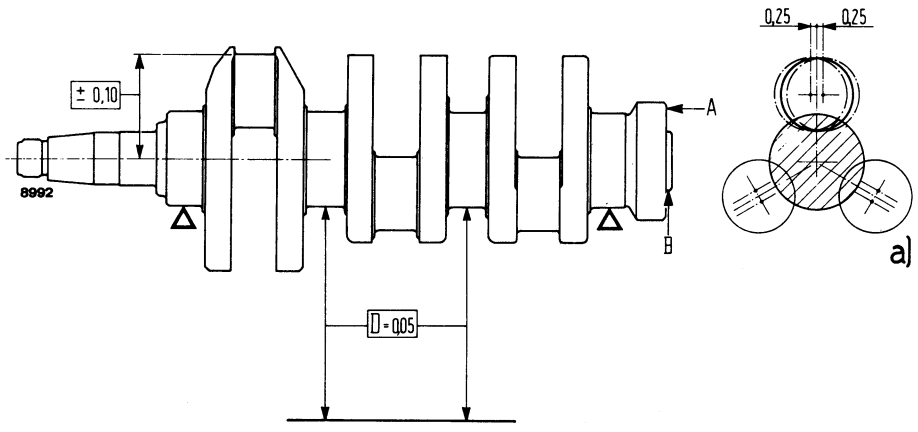
ENGINE: Specification

CRANK GEAR

/Continued

	in	mm
Crankshaft thrust washer thickness	0.133 to 0.135	3.378 to 3.429
Thrust washer oversize	0.005	0.127
Width of main bearing housing over thrust washers	1.250 to 1.260	31.766 to 31.918
Length of corresponding main journal...	1.261 to 1.264	32.000 to 32.100
Crankshaft end float	0.003 to 0.013	0.082 to 0.334
- Maximum wear end float	0.016	0.40
Maximum main journal and crank pin ovality or taper after grinding	0.0003	0.01
Maximum main journal and crank pin ovality or taper due to wear	0.002	0.05
Maximum main journal misalignment with crankshaft resting on end journals	0.002	0.05
Maximum crank pin misalignment relative to main journals (either direction)....	0.010	0.25
Maximum tolerance on distance from outer crank pin edge to crankshaft centreline	± 0.004	± 0.10
Maximum crankshaft flange runout dia. (TIR),A over 90 mm (3.5 in)	0.001	0.025
Maximum flywheel seat eccentricity relative to main journals (TIR), at B.	0.002	0.04

Continued ....



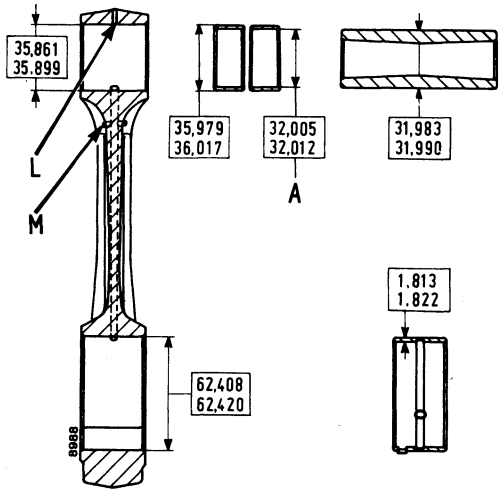
Maximum misalignment of main journals and crank pins relative to crankshaft centreline and of crank pins relative to main journals (a).

A and B. Dial gauge positions for checking crankshaft flange run-out and flywheel seat eccentricity. - D. Max. main journal misalignment.

CRANK GEAR /Continued

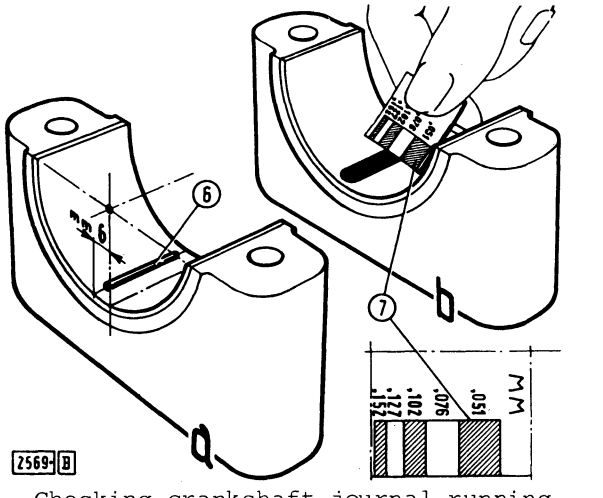
Connecting rods	in	mm
Small end bore diameter	1.412 to 1.413	35.861 to 35.899
Small end bushing O.D.	1.416 to 1.418	35.979 to 36.017
Bushing interference fit in small end..	0.0008 to 0.006	0.080 to 0.156
Bushing fitted I.D.	1.260 to 1.261	32.005 to 32.012
Big end bore diameter	2.457 to 2.458	62.408 to 62.420
Maximum connecting rod axis misalignment at 125 mm (5 in)	± 0.003	± 0.07
Maximum connecting rod weight difference over a complete set of the same engine.	0.353 ounces	10 grammes
Pistons		
Piston protrusion above engine block at top dead centre	0.018 to 0.031	0.462 to 0.787
Piston diameter at 50 mm (2 in) from base of skirt, at right angles to pin:		
- Class A	3.733 to 3.734	94.842 to 94.854
- Class B	3.734 to 3.735	94.854 to 94.866
Piston clearance in sleeve	0.006 to 0.007	0.146 to 0.170
- Maximum wear clearance	0.012	0.30
Piston oversize range	0.008 - 0.016 - 0.024 - 0.031	0.2 - 0.4 - 0.6 - 0.8

Continued .....



Connecting rod, bearing, bushing and pin details

A. Fitted dimension after reaming - H, L and M. Lubricant ways.



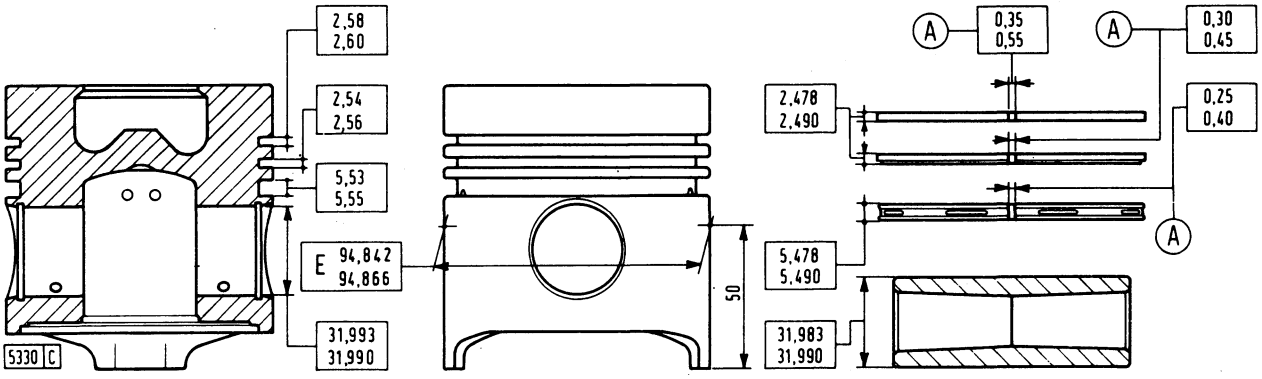
Checking crankshaft journal running clearance

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

ENGINE: Specification

CRANK GEAR /Continued

	in	mm
Piston pin diameter	1.2590 to 1.2594	31.983 to 31.990
Pin housing bore diameter in piston ...	1.2590 to 1.2594	31.983 to 31.990
Piston pin fit in piston		
- Clearance	0.000 to 0.0002	0.000 to 0.007
- Interference	0.000 to 0.0002	0.000 to 0.007
Piston pin oversize	0.008 - 0.019	0.2 - 0.5
Piston pin clearance in small end bushing	0.0005 to 0.001	0.015 to 0.029
- Maximum wear clearance	0.024	0.06
Maximum weight difference over a complete set of pistons	0.353 ounces	10 grammes
Piston ring clearance in groove :		
- Top	0.0035 to 0.004	0.090 to 0.122
- 2nd	0.002 to 0.003	0.050 to 0.082
- 3rd	0.002 to 0.003	0.040 to 0.072
Maximum wear clearance:		
- Top	0.019	0.50
- 2nd and 3rd	0.008	0.20
Piston ring gap:		
- Top	0.014 to 0.022	0.35 to 0.55
- 2nd	0.012 to 0.018	0.30 to 0.45
- 3rd	0.010 to 0.015	0.25 to 0.40
Maximum wear gap	0.039	1.00



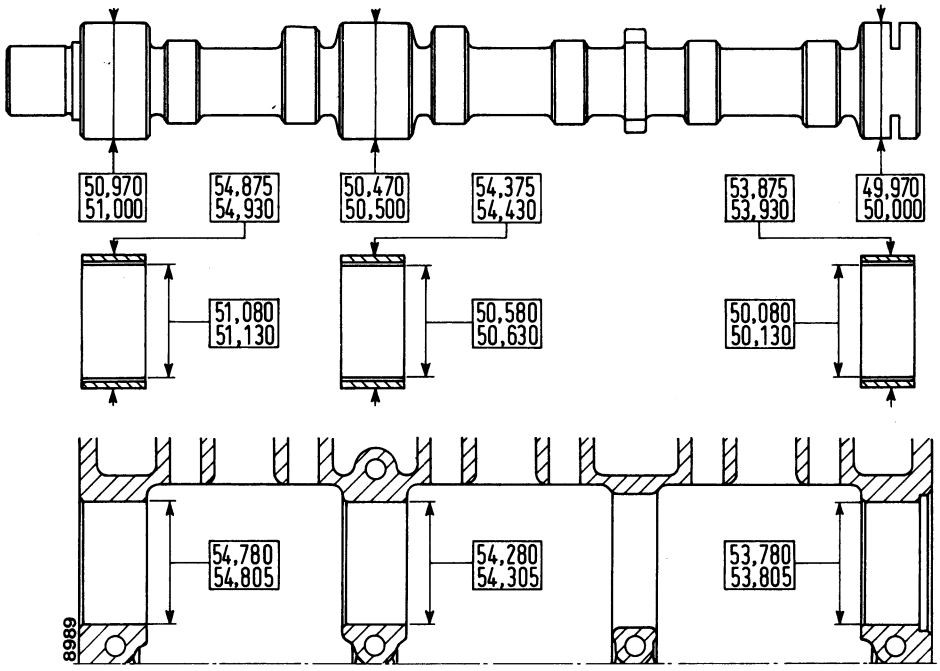
Piston, pin and ring details

A. Piston ring fitted gap - E. Piston diameter as measured 50 mm (2 in) from base of skirt (see table on page 5).

VALVE GEAR

Camshaft	in	mm
Camshaft bushing O.D.:		
- Front	2.160 to 2.163	54.875 to 54.930
- Intermediate	2.140 to 2.143	54.375 to 54.430
- Rear.....	2.121 to 2.123	53.875 to 53.930
Bushing interference fit in housing ...	0.003 to 0.006	0.070 to 0.150
Camshaft bushing fitted I.D. after reaming:		
- Front	2.011 to 2.013	51.080 to 51.130
- Intermediate	1.991 to 1.993	50.580 to 50.630
- Rear	1.972 to 1.974	50.080 to 50.130
Camshaft journal diameter:		
- Front	2.007 to 2.008	50.970 to 51.000
- Intermediate	1.987 to 1.988	50.470 to 50.500
- Rear	1.967 to 1.969	49.970 to 50.000
Camshaft journal clearance in bushing..	0.003 to 0.006	0.080 to 0.160
- Maximum wear clearance	0.008	0.20
Camshaft end float (thrust plate to associated seat in camshaft)	0.003 to 0.009	0.070 to 0.220

Continued .....



Camshaft journal and housing details

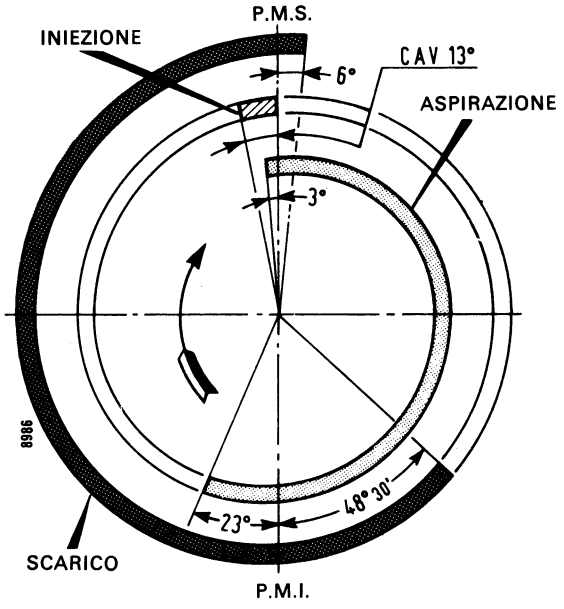
Note - Bushing fitted I.D. given.

ENGINE: Specification

VALVE GEAR /Continued

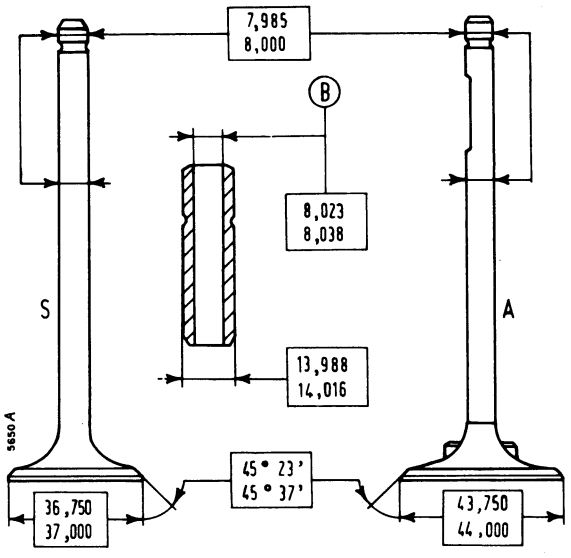
		in	mm
Rockers			
Rocker bushing O.D.		0.827 to 0.828	21.006 to 21.031
Rocker bore diameter		0.824 to 0.826	20.939 to 20.972
Bushing interference fit in rocker		0.001 to 0.004	0.034 to 0.092
Rocker bushing fitted diameter		0.709 to 0.710	18.016 to 18.034
Rocker shaft diameter		0.708 to 0.709	17.982 to 18.000
Rocker shaft clearance in bushing		0.001 to 0.002	0.016 to 0.052
- Maximum wear clearance		0.008	0.20
Rocker spacer spring length:			
- Free		2.343	59.5
- Under 4.7 to 5.3 kg (10.4 to 11.7lb)		1.732	44
Valves, guides and springs			
Valve dimensions		See figure	
Valve clearance	Timing check	0.018	0.45
	Normal (cold or warm) Intake	0.010	0.25
	Normal (cold or warm) Exhaust	0.014	0.35
Valve lift	Intake	0.217	5.500
	Exhaust	0.237	6.027

Continued ....



Valve timing diagram

INIEZIONE = Injection - P.M.S. = T.D.C.
ASPIRAZIONE = Intake - SCARICO = Exhaust
P.M.I. = B.D.C.



Valve and guide details

A. Intake - B. Fitted diameter - S. Exhaust.

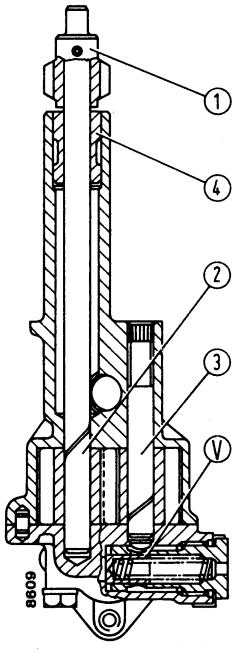
VALVE GEAR /Continued

	in	mm
Valve guide O.D.	0.551 to 0.552	13.988 to 14.016
Valve guide oversize	0.008	0.2
Valve guide interference fit in housing on cylinder head	0.0001 to 0.002	0.005 to 0.050
Valve guide fitted I.D.	0.316 to 0.317	8.023 to 8.038
Valve stem clearance in guide	0.001 to 0.002	0.023 to 0.053
- Maximum wear clearance	0.005	0.13
Maximum valve stem eccentricity over one revolution with stylus on sealing face	0.002	0.04
Intake and exhaust valve spring length:		
- Free	2.579	65.5
- Valve closed, under 30.1 to 33.9 kg (66.4 to 74.7 lb.)	1.614	41
- Valve open, under 48.1 to 52.1 kg (106 to 114.8 lb.)	1.213	30.8
Tappets		
Tappet O.D.	0.549 to 0.550	13.950 to 13.970
Tappet clearance in housing on engine block	0.001 to 0.003	0.030 to 0.068
- Maximum wear clearance	0.006	0.15
Tappet oversize	0.004 - 0.008 - 0.012	0.1 - 0.2 - 0.3
Valve timing gears		
Timing gear backlash	0.003	0.08
Idler gear jackshaft diameter	1.255 to 1.256	31.975 to 32.000
Idler gear bushing fitted I.D. after reaming	1.261 to 1.263	32.050 to 32.075
Jackshaft journal clearance in bushing.	0.002 to 0.004	0.050 to 0.100
- Maximum wear clearance	0.006	0.15
Bushing interference fit in idler gear.	0.002 to 0.005	0.063 to 0.140
Lift pump gear shaft diameter	1.455 to 1.457	36.975 to 37.000
Bushing fitted I.D. after reaming	1.459 to 1.460	37.050 to 37.075
Shaft clearance in bushings	0.002 to 0.004	0.050 to 0.100
Bushing interference fit in housing	0.002 to 0.006	0.063 to 0.140
Pump gear thrust washer thickness	0.057 to 0.059	1.45 to 1.50

ENGINE: Specification - Pump sections

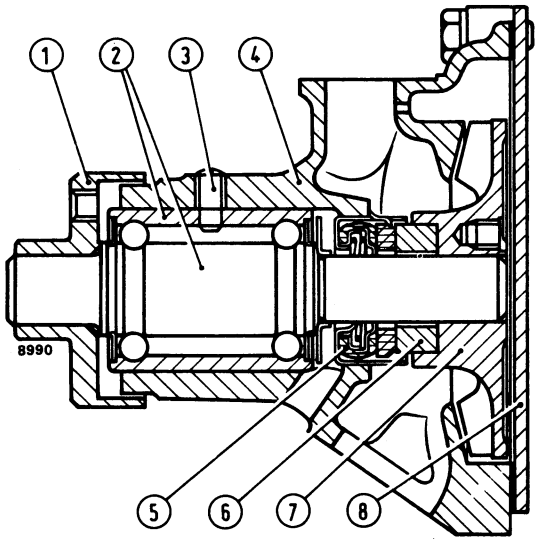
LUBRICATION SYSTEM

Oil pump	Gear, camshaft driven
Oil pump drive ratio	2 to 1
Oil pressure, warm, at governed speed..	3 to 4 kg/cm^2 (2.9 to 3.9 bar 42.6 to 56.9 psi)
Relief valve crack off setting	3.6 kg/cm^2 (3.5 bar, 51.2 psi)
Shaft clearance in fitted bushing	0.001 to 0.002 in 0.016 to 0.055 mm
Shaft clearance in driven gear	0.001 to 0.003 in 0.033 to 0.066 mm
Gear backlash	0.004 in 0.100 in
Radial clearance in pump body	0.004 to 0.006 in 0.090 to 0.140 mm
Drive and driven gear width	1.613 to 1.614 in 40.961 to 41.000 mm
Gear recess depth in pump body	1.615 to 1.618 in 41.025 to 41.087 mm
Drive and driven gear end float	0.001 to 0.005 in 0.025 to 0.126 mm
Relief valve spring length:	
- Free	1.772 in 45 mm
- Under 9 to 9.6 kg (19.8 to 21.2 lb.)	1.200 in 30.5 mm
Oil filter	Gauze on suction and cartridge on delivery



Section through oil pump

V. Relief valve -
1. Outer drive gear -
2. Drive gear shaft -
3. Driven gear shaft -
4. Bushing.

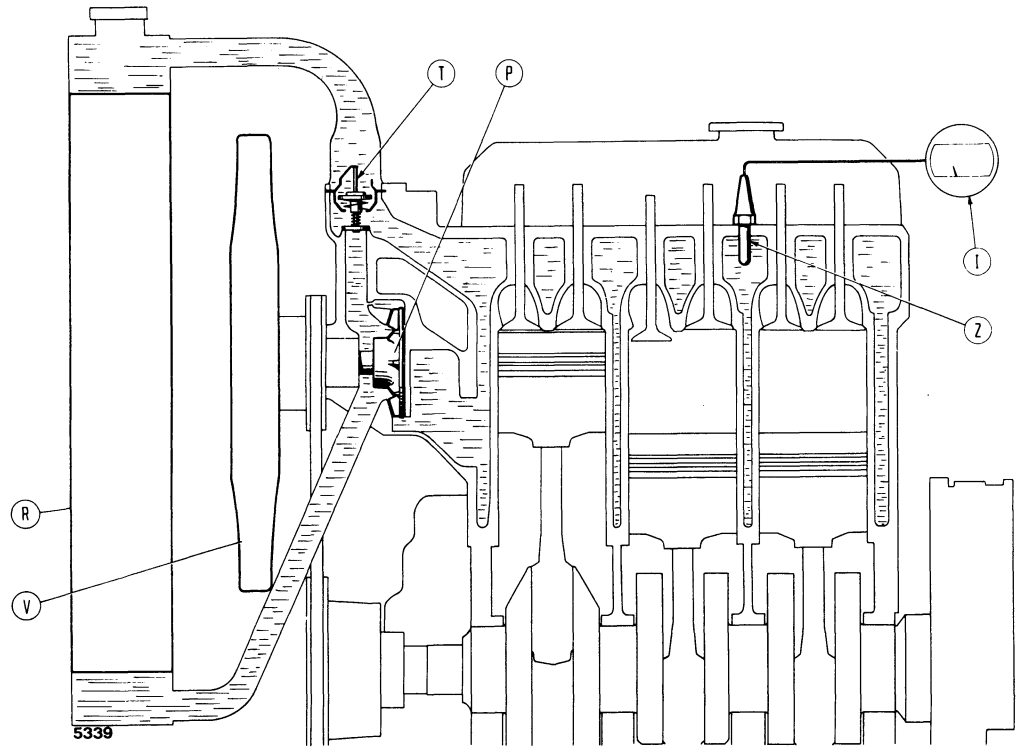


Section through water pump

1. Drive hub - 2. Drive shaft assembly
3. Bearing capscrew - 4. Pump body -
5. Seal - 6. Bushing - 7. Impeller -
8. Cover.

COOLING SYSTEM

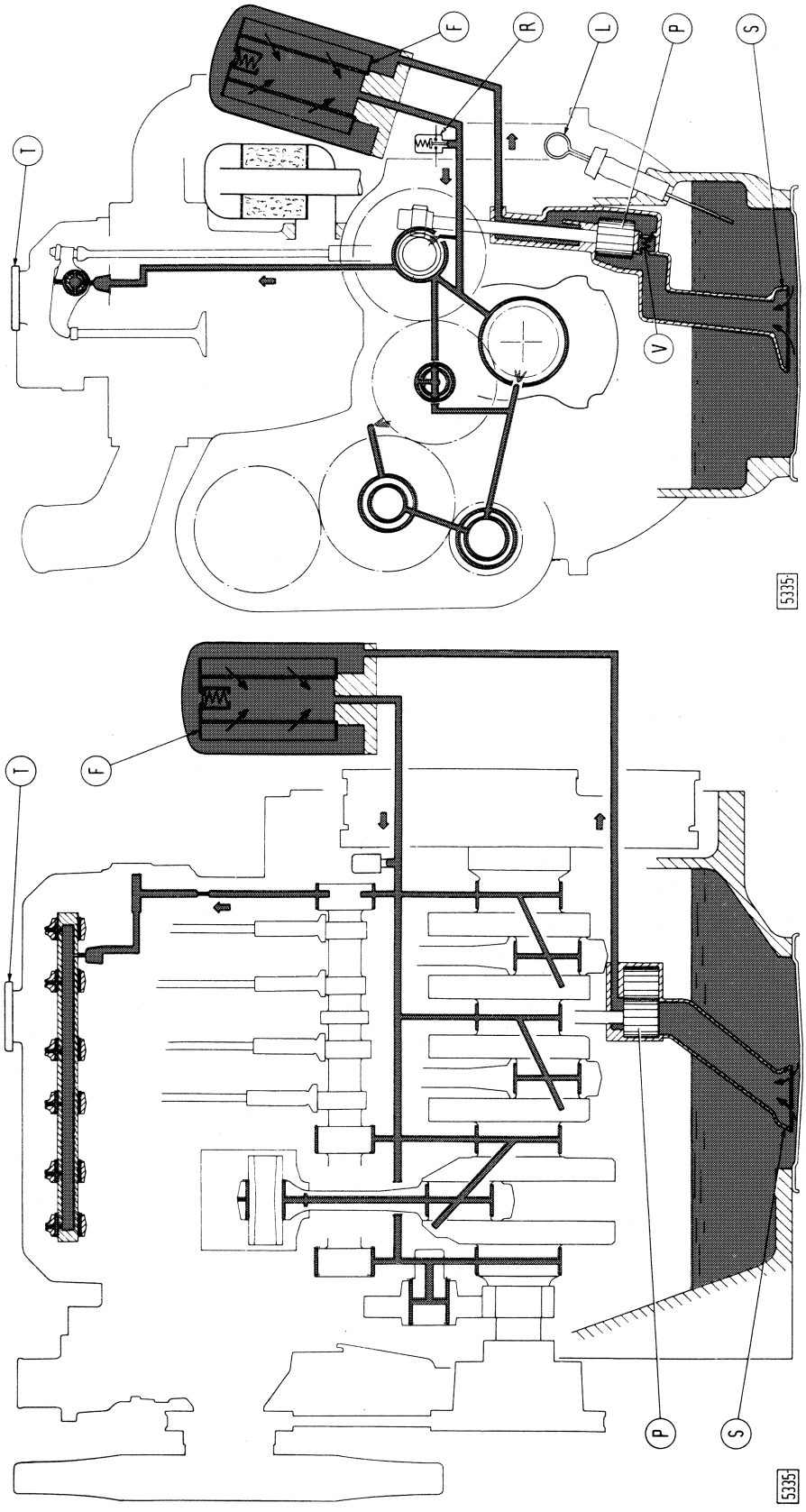
Water pump	Centrifugal, vane	
Water pump drive ratio	1 to 1.410	
	in	mm
Shaft interference fit in impeller	0.001 to 0.002	0.027 to 0.060
Shaft interference fit in fan hub	0.001 to 0.002	0.015 to 0.061
Face sealing bushing interference fit in impeller	0.001 to 0.002	0.012 to 0.058
Thermostat		
Type	BEHR-THOMSON or SAVARA or FLEXIDER	
Opening temperature	79 ± 2 °C	
Open at { Type FLEXIDER or SAVARA	94°C	
Open at { Type BEHR-THOMSON	95°C	
Valve travel when fully open	0.291 in	7.5 mm
Radiator	Vertical tube and copper fins, 3-deep	
Fan	Suction, steel, 4-blades	



Cooling system diagram

I. Water temperature gauge - P. Pump - R. Vertical tube radiator - T. Thermostat - V. 6-blade fan - Z. Thermometer bulb.

ENGINE:
Lubrication system diagram



Lubrication system diagram

F. Cartridge filter - L. Dipstick - P. Gear pump - R. Oil pressure warning sending unit - S. Gauze filter - T. Oil filler - V. Relief valve.

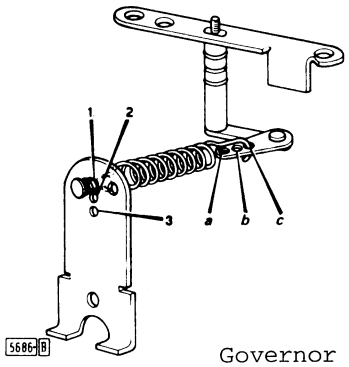
FUEL SYSTEM

Lift pump	Double diaphragm	
Operation	Engine driven	
Minimum fuel flow at 1600 rpm	100 litre/hour	22 Gall/hour
Drive shaft eccentricity	0.118 in	3 mm
Lift pump drive	in	mm
Shaft journal diameter	1.259 to 1.260	31.975 to 32.000
Bush fitted I.D. after reaming	1.262 to 1.263	32.050 to 32.075
Shaft clearance in bushing	0.002 to 0.004	0.050 to 0.100
Bushing interference fit	0.002 to 0.006	0.063 to 0.140
Inner washer thickness	0.057 to 0.059	1.45 to 1.50
Outer washer thickness	0.115 to 0.118	2.93 to 3.00
Injection pump	Distributor, integral governor	
C.A.V. type	DPA 3233 F 330 - A 49 / 800 / 3 / 2750 - 771103	
Direction of rotation (seen from drive side)	Anticlockwise	
Firing order	1 - 2 - 3	
Fuel injectors		
FIAT type	EPPZ 10 F 1 - 767103	
Nozzle holder	KB 70 S 1 F 10 - 767107	
Spray nozzle	DLL 145 S 50 F - 767104	
No. of spray orifices	4	
Spray orifice diameter	0.012 in	0.30 mm
Release pressure	225 to 235 kg/cm^2 (220 to 230 bar, 3200 to 3342 psi)	
Delivery pipes:		
- Type	PRR 11 F 15Z - 768356	
- Pipe size	.079 x .236 x 16.81 in	2 x 6 x 427 mm

CALIBRATION DATA - C.A.V. INJECTION PUMP - Type DPA 3233 F 330 - 771103

ASSEMBLY DATA

Pump rotation (drive end)...Anticlockwise
Firing order .....1 - 2 - 3
Governor control stud to
metering valve lever pin....53.75mm(2.116in)
Roller spacing .....49.66mm(1.955in)
Pump timing .....13±1° B.T.D.C.
in cylinder 1 in compression stroke.
External timing mark degree position with
respect to shaft key (on tool 290757).
.....268°
Delivery connection of cylinder no 1:
.....Marked with letter W



Governor spring mounting holes: 1 - c.

TEST PLAN

Procedure A

BOSCH test machine with WSF 2044/4 X injector springs and EFEP 182 spray nozzle.
RABOTTI test machine with FIAT 656829 injector springs and EFEP 182 spray nozzles.
Release pressure .. 175kg/cm^2 (2483 psi)
Pipes ..... mm 2 x 6 x 865

Procedure B

Test machine incorporating injector bodies and nozzles as fitted to engine.
Release pressure .... 225 to 235 kg/cm^2 (3,200 to 3,343 psi)
Pipes ..... 2 x 6 x 700 mm
Calibration fluid .... FIAT CFB at 30+5°C
Fuel pressure ... 0.2 kg/cm^2 (2.84 psi)

Test no.	Lever position L_1 = Throttle L_2 = Shut-off	Speed rpm	Transfer pressure kg/cm^2	Advance degrees	Procedure A Delivery		Proc. B
					Inj.delivery cm^3/1000 shots	Back leakage cm^3/1000 shots	Inj.delivery cm^3/1000 shots
1 - 2	–	100	1,2 ÷ 1,8	–	–	–	–
3	–	800	–	5,5 ÷ 6,5	–	–	–
4	–	1300	–	7,3 ÷ 7,8	–	–	–
5	–	180	–	2,3 ÷ 2,5	–	–	–
6 (1)	–	300	–	0	–	–	–
7	–	950	–	7,3 ÷ 7,8	–	–	–
8 - 9 10 (2)	L_1 = Full L_2 = Out	1300 $^{+0}_{-20}$	5,4 ÷ 6,4	–	53 ÷ 56 (•)	⩾ 14	46 ÷ 49 (•)
11 - 12		800 ±5	3,8 ÷ 4,6	–	47 ÷ 50 (•)	–	50 ÷ 53 (•)
13 (1)		100	–	–	⩾ 44	–	–
14	L_1 = Full L_2 = In	200	–	–	⩽ 4	–	–
15 (2)	L_1 = Idle L_2 = Out	200	–	–	⩽ 5	–	–
16 (3)	L_1 = Full L_2 = Out	1370	–	–	⩽ 9	–	–
17 (4)		1300 $^{+0}_{-20}$	–	–	53 ÷ 56	–	–

Carry out tests from 1 to 5 replacing start retard with tool 290760.
Carry out other tests with start retard fitted.

(°) Max.spread: 4cm^3/1000 shots.
(1) Manual start retard activated.
(2) Fully back off throttle lever adjusting screws.
(3) Governor cut-in. Adjust max.speed screw.
(4) Recheck fuelling.

ON-BENCH PERFORMANCE DATA

Test plan

Engine on bench with fan, air cleaner and exhaust silencer removed.
Parametric pressure: 740 ± 5 mm hg.

Ambient temperature: 20 ± 3 °C
Relative humidity : 70% ± 5
Fuel density : 830 ± 10 g/litre

Throttle	Engine rpm	Metric HP		Time to burn 100cc of fuel (sec.)
		2-hour run-in	50-hour run-in	
Max. (full load)	2600	⩾ 44 (32,4 kW)	⩾ 46 (33,8 kW)	⩾ 34
Max. (max. torque)	1500	⩾ 28 (20,6 kW)	⩾ 29 (21,3 kW)	⩾ 54,5
Max. (no load)	⩽ 2750	–	–	–
Min. (no load)	600 ÷ 650	–	–	–