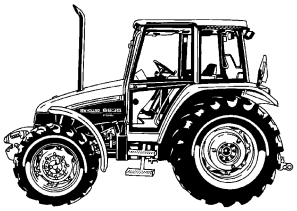
Please cut where indicated and insert the label into the plastic pocket on the spine of the binder.

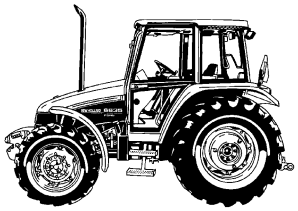


35 SERIES TRACTOR REPAIR

4835, 5635, 6635, 7635

Vol. 1

86566075

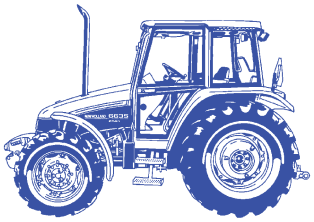


35 SERIES TRACTOR REPAIR

4835, 5635, 6635, 7635

Vol. 1

86566075



NEW HOLLAND

REPAIR MANUAL

4835 5635
6635 7635

Section 1 – General Information

NEW HOLLAND

SERVICE

86566076 3/98

35 SERIES REPAIR MANUAL CONTENTS

SECTION 1
GENERAL INFORMATION
CONTENTS

GENERAL INSTRUCTIONS

IMPORTANT NOTICE

All maintenance and repair operations described in this manual should be carried out exclusively by authorized workshops. All instructions detailed should be carefully observed and special equipment indicated should be used if necessary.
Everyone who carries out service operations described without carefully observing these prescriptions will be directly responsible of deriving damages.

SHIMMING

At each adjustment, select adjusting shims, measure them individually using a micrometer and then sum up recorded values. Do not rely on measuring the whole shimming set, which may be incorrect, or on the rated value indicated for each shim.

ROTATING SHAFT SEALS

To correctly install rotating shaft seals, observe the following instructions:

- Let the seal soak into the same oil as it will seal for at least half an hour before mounting;
- Thoroughly clean the shaft and ensure that the shaft working surface is not damaged;
- Place the sealing lip towards the fluid. In case of a hydrodynamic lip, consider the shaft rotation direction and orient grooves in order that they deviate the fluid towards the inner side of the seal;
- Coat the sealing lip with a thin layer of lubricant (oil rather than grease) and fill with grease the gap between the sealing lip and the dust lip of double lip seals;
- Insert the seal into its seat and press it down using a flat punch. Do not tap the seal with a hammer or a drift;
- Take care to insert the seal perpendicularly to its seat while you are pressing it. Once the seal is settled, ensure that it contacts the thrust element, if required;
- To prevent damaging the sealing lip against the shaft, place a suitable protection during installation.

O RINGS

Lubricate the O rings before inserting them into their seats. This will prevent the O rings from rollover and twisting during mounting, which will jeopardize sealing.

SEALERS

Apply one of the following sealers: RTV SILMATE, RHODORSIL CAF 1, or LOCTITE PLASTIC GASKET over the mating surfaces marked with an X.
Before applying the sealer, prepare the surface as follows:

- remove possible scales using a metal brush;
- thoroughly degrease the surfaces using one of the following cleaning agents: trichlorethylene, diesel fuel or a water and soda solution.

BEARINGS

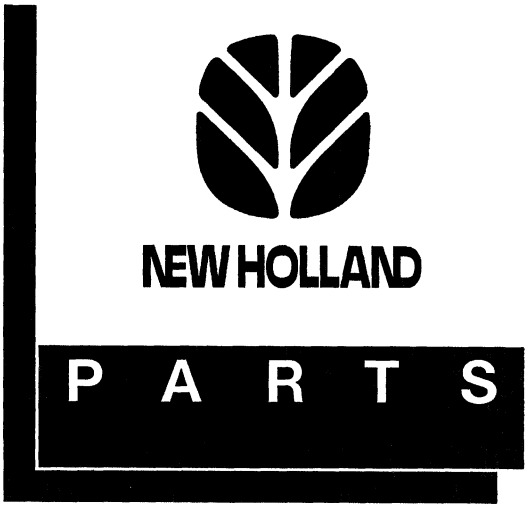
It is advisable to heat the bearings to 80° to 90°C (176° to 194° F) before mounting them on their shafts and cool them down before inserting them into their seats with external tapping.

SPRING PINS

When mounting split socket spring pins, ensure that the pin notch is oriented in the direction of the effort to stress the pin.
Spiral spring pins should not be oriented during installation.

NOTES FOR SPARE PARTS

Use exclusively **genuine NEW HOLLAND spare parts**, the only ones bearing this logo.



Only genuine parts guarantee the same quality, life, and safety as original components, as they are the same as mounted in production.
Only the **NEW HOLLAND genuine spare parts** can offer this guarantee.
All spare parts orders should be complete with the following data:

- tractor model (commercial name) and ID number;
- engine type and ID number;
- part number of the ordered part, which can be found on the "Microfiches" or the "Spare Parts Catalogue", which is the base for order processing.

NOTES FOR EQUIPMENT

Equipment which NEW HOLLAND proposes and shows in this manual are as follows:

- studied and designed expressly for use on NEW HOLLAND tractors;
- necessary to make a reliable repair;
- accurately built and strictly tested to offer efficient and long-lasting working means.

We also remind the Repair Personnel that having this equipment means:

- work in optimal technical conditions;
- obtain best results;
- save time and effort;
- work more safely.

NOTICES

Wear limits indicated for some details should be intended as advised, but not binding values. The words "front", "rear", "right hand", and "left hand" referred to the different parts should be intended as seen from the operator's seat oriented to the normal sense of movement of the tractor.

HOW TO MOVE THE TRACTOR WITH THE BATTERY REMOVED

Cables from the external power supply should be connected exclusively to the respective terminals of the tractor positive and negative cables using pliers in good condition which allow proper and steady contact.
Disconnect all services (lights, wind-shield wipers, etc.) before starting the tractor.
If it is necessary to check the tractor electrical system, check it only with the power supply connected. At check end, disconnect all services and switch the power supply off before disconnecting the cables.

SAFETY RULES

PAY ATTENTION TO THIS SYMBOL

This warning symbol points out important messages involving personal safety. Carefully read the safety rules contained herein and follow advised precautions to avoid potential hazards and safeguard your safety and personal integrity.
In this manual you will find this symbol together with the following key-words:

***WARNING** - it gives warning about improper repair operations and deriving potential consequences affecting the service technician's personal safety.*

***DANGER** - it gives specific warning about potential dangers for personal safety of the operator or other persons directly or indirectly involved.*

TO PREVENT ACCIDENTS

Most accidents and personal injuries taking place in workshops are due from non-observance of some simple and essential prudent rule and safety precaution. For this reason, IN MOST CASES THEY CAN BE AVOIDED. It suffices to foresee possible causes and act consequently with necessary caution and care.

The possibility that an accident might occur with any type of machine should not be disregarded, no matter how well the machine in question was designed and built.

A wise and careful service technician is the best precaution against accidents.

Careful observance of only this basic precaution would be enough to avoid many severe accidents.

DANGER: Never carry out any cleaning, lubrication or maintenance operations when the engine is running.

SAFETY RULES

GENERALITIES

◊ Carefully follow specified repair and maintenance procedures.

◊ Do not wear rings, wristwatches, jewels, unbuttoned or flapping clothing such as ties, torn clothes, scarves, open jackets or shirts with open zips which could get caught in moving parts. We advise to use approved safety clothing such as anti-slipping footwear, gloves, safety goggles, helmets, etc.

◊ Never carry out any repair on the machine if someone is sitting on the operator's seat, except if they are certified operators to assist in the operation to be carried out.

◊ Never operate the machine or use attachments from a place other than sitting at the operator's seat.

◊ Never carry out any operation on the machine when the engine is running, except when specifically indicated.

◊ Stop the engine and ensure that all pressure is relieved from hydraulic circuits before removing caps, covers, valves, etc.

◊ All repair and maintenance operations should be carried out with the greatest care and attention.

◊ Service stairs and platforms used in a workshop or in the field should be built in compliance with the safety rules in force.

◊ Disconnect the batteries and label all controls to warn that the tractor is being serviced. Block the machine and all equipment which should be raised.

◊ Never check or fill fuel tanks and accumulator batteries, nor use starting liquid if you are smoking or near open flames as such fluids are flammable.

◊ Brakes are inoperative when they are manually released for maintenance purposes. In such cases, the machine should be kept constantly under control using blocks or similar devices.

◊ The fuel filling gun should remain always in contact with the filler neck. Maintain this contact until the fuel stops flowing into the tank to avoid possible sparks due to static electricity buildup.

◊ Use exclusively specified towing points for towing the tractor. Connect parts carefully. Ensure that foreseen pins and/or locks are steadily fixed before applying traction. Do not stop near towing bars, cables or chains working under load.

◊ To transfer a failed tractor, use a trailer or a low loading platform trolley if available.

◊ To load and unload the machine from the transport vehicle, select a flat area providing a firm support to the trailer or truck wheels. Firmly tie the machine to the truck or trailer platform and block wheels as required.

◊ For electrical heaters, battery-chargers and similar equipment, use exclusive auxiliary power supplies with an efficient ground to avoid electrical shock.

◊ Always use lifting equipment of appropriate capacity to lift or move heavy components.

◊ Pay special attention to bystanders.

◊ Never pour gasoline or diesel fuel into open, wide and low containers.

◊ Never use gasoline, diesel fuel or other flammable liquids as cleaning agents. Use non-flammable non-toxic proprietary solvents.

◊ Wear protection goggles with side guards when cleaning parts using compressed air.

◊ Do not exceed a pressure of 2.1 bar (30.5 psi), in accordance with local regulations.

◊ Do not run the engine in a closed building without proper ventilation.

◊ Do not smoke, use open flames, cause sparks in the nearby area when filling fuel or handling highly flammable liquids.

◊ Do not use flames as light sources when working on a machine or checking for leaks.

◊ Move with caution when working under a tractor, and also on or near a tractor. Wear proper safety accessories: helmets, goggles and special footwear.

◊ During checks which should be carried out with the engine running, ask an assistant to sit in the operator's seat and keep the service technician under visual supervision at any moment.

◊ In case of operations outside the workshop, drive the tractor to a flat area and block it. If working on an incline cannot be avoided, first block the tractor carefully. Move it to a flat area as soon as possible with a certain extent of safety.

◊ Ruined or plied cables and chains are unreliable. Do not use them for lifting or trailing. Always handle them wearing gloves of proper thickness.

◊ Chains should always be safely fastened. Ensure that fastening device is strong enough to hold the load foreseen. No persons should stop near the fastening point, trailing chains or cables.

◊ The working area should be always kept CLEAN and DRY. Immediately clean any spillage of water or oil.

◊ Do not pile up grease or oil soaked rags, as they constitute a great fire hazard. Always place them into a metal container.
Before starting the tractor or its attachments, check, adjust and block the operator's seat. Also ensure that there are no persons within the tractor or attachment operating range.

◊ Do not keep in your pockets any object which might fall unobserved into the tractor's inner compartments.

◊ Whenever there is the possibility of ejected metal parts or similar, use protective eye mask or goggles with side guards, helmets, special footwear and heavy gloves.

◊ Wear suitable protection such as tinted eye protection, helmets, special clothing, gloves and footwear whenever it is necessary to carry out welding procedures. All persons standing in the vicinity of the welding process should wear tinted eye protection. NEVER LOOK AT THE WELDING ARC IF YOUR EYES ARE NOT SUITABLY PROTECTED.

◊ Metal cables with use get frayed. Always wear adequate protections (heavy gloves, eye protection, etc.).

◊ Handle all parts with the greatest caution. Keep your hands and fingers far from gaps, moving gears and similar. Always use approved protective equipment, such as eye protection, heavy gloves and protective footwear.

START UP

◊ Never run the engine in confined spaces which are not equipped with adequate ventilation for exhaust gas extraction.

◊ Never bring your head, body, arms, legs, feet, hands, fingers near fans or rotating belts.

ENGINE

◊ Always loosen the radiator cap very slowly before removing it to allow pressure in the system to dissipate. Coolant should be topped up only when the engine is stopped or idle if hot.

◊ Do not fill up fuel tank when the engine is running, or if it is hot, to avoid ignition of fires in case of fuel spilling.

◊ Never check or adjust the fan belt tension when the engine is running.
Never adjust the fuel injection pump when the tractor is moving.

◊ Never lubricate the tractor when the engine is running.

ELECTRICAL SYSTEMS

◊ If it is necessary to use auxiliary batteries, cables must be connected at both sides as follows: (+) to (+) and (-) to (-). Avoid short-circuiting the terminals. GAS RELEASED FROM BATTERIES IS HIGHLY FLAMMABLE. During charging, leave the battery compartment uncovered to improve ventilation. Avoid checking the battery charge by means of "jumpers" made by placing metallic objects across the terminals. Avoid sparks or flames near the battery area. Do no smoke to prevent explosion hazards.

◊ Prior to any service, check for fuel or fluid leaks. Remove these leaks before going on with the work.

◊ Do not charge batteries in confined spaces. Ensure that ventilation is appropriate to prevent accidental explosion hazard due to build-up of gasses relieved during charging.

◊ Always disconnect the batteries before performing any type of service on the electrical system.

HYDRAULIC SYSTEMS

◊ Some fluid slowly coming out from a very small port can be almost invisible and be strong enough to penetrate the skin. For this reason, NEVER USE YOUR HANDS TO CHECK FOR LEAKS, but use a piece of cardboard or a piece of wood to this purpose. If any fluid is injected into the skin, seek medical aid immediately. Without immediate medical attention, serious infections or dermatosis may result.

◊ Always take system pressure readings using the appropriate gauges.

WHEELS AND TIRES

◊ Check that the tires are correctly inflated at the pressure specified by the manufacturer. Periodically check possible damages to the rims and tires.

◊ Check the pressure only when the tractor is unloaded and tires are cold to avoid wrong readings due to over-pressure. Do not reuse parts of recovered wheels as improper welding, brazing or heating may weaken the wheel and make it fail.

◊ Never cut, nor weld a rim with the inflated tire assembled.

◊ To remove the wheels, block both front and rear tractor wheels. Raise the tractor and install safe and stable supports under the tractor in accordance with regulations.

◊ Deflate the tire before removing any object caught in the tire tread.

◊ Never inflate tires using flammable gasses as they may originate explosions and cause injuries to bystanders.

REMOVAL AND INSTALLATION

◊ Lift and handle all heavy components using lifting equipment of adequate capacity. Ensure that parts are supported by appropriate slings and hooks. Use lifting eyes provided to this purpose. Take care of the persons near the loads to be lifted.

◊ Handle all parts with great care. Do not place your hands or fingers between two parts. Wear approved protective clothing such as safety goggles, gloves and footwear.

◊ Do not twine chains or metal cables. Always wear protection gloves to handle cables or chains.

CONSUMABLES

PART TO BE FILLED	Quantity dm^3 litres (US gal)	New Holland Recommended Product	New Holland Specification	International Specification
Cooling system: - without cab: 65, 75, 85 and 95 HP models ..... - with cab: 65, 75, 85 and 95 HP models	14 (3.70 US gal) 16 (4.23 US gal)	50% Antifreeze Plus 50% Clean, Soft Water	M97B18-D	WSN-M97B18-D
Windscreen washer tank ...	2 (0.53 US gal)	Water and Washer Fluid	-	-
Fuel tank, all models.	110 (29.0 US gal)	Decanted and Filtered Diesel Fuel	-	40 min. Cetne Rating (No. 2)
Crankcase sump: - without filter: 65, 75, 85 and 95 HP models ..... - with filter: 65, 75, 85 and 95 HP models	9.5 (2.51 US gal) 10.5 (2.77 US gal)	Premium Multi-Grade Engine Oil	SH/CG-4 API15W-40)	API CF-4/SG CCMC D4 MIL-L-2104E
Brake control circuit	0.4 (0.42 US qt)	Brake Oil	M97B18-D	-
Front axle: axle case: - 65 and 75 HP models ..... - 85 and 95 HP models ..... lateral final drives (each): - 65 and 75 HP models ..... - 85 and 95 HP models ..... Rear transmission (bevel gear pair - lateral final drives and brakes), gearbox, hydraulic lift, PTO and hydrostatic steering: - 65 and 75 HP models . - 85 and 95 HP models ..... With synchronised reverser, all models	4.5 (1.19 US gal) 7.0 (1.85 US gal) 0.8 (0.84 US qt) 1.25 (1.32 US qt) 49 (12.94 US gal) 55 (14.53 US gal) 55 (14.53 US gal)	Multigrade Transmission, Rear Axle, and Hydraulic Oil	134-D 85700812	API GL4 ISO 32/46 SAE 10W-30
Front wheel hubs	-	Multipurpose Grease Extreme Pressure (EP)	865033661	NLGI 2 ESE-M1C75-B ESN-M1C137-B
Compression cups	-			

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS	4-cylinder
Engine type:	
- mod. 65 hp norm. aspirated - type 8045.06R.213/214/215 (BOSCH pump)	Pages 2-7 - 2-8
- mod. 75 hp norm. aspirated - type 8045.05R.214/215 (BOSCH pump)	Pages 2-9 - 2-10
- mod. 85 hp turbocharged - type 8045.25.203/204/205 (BOSCH pump)	Pages 2-11 - 2-12
- mod. 95 hp turbocharged - type 8045.25k.213/215 (BOSCH pump)	Pages 2-13 - 2-14
Cycle	Diesel, 4-stroke
Fuel injection	Direct
No. of in-line cylinders	4
Cylinder liners	dry force-fitted in cylinder block
Piston diameter	
- mod. 65 hp	100 mm (3.937 in.)
- mod. 75 hp	104 mm (4.094 in.)
- mod. 85 hp	104 mm (4.094 in.)
- mod. 95 hp	104 mm (4.094 in.)
Piston stroke	115 mm (4.528 in.)
Total displacement:	
- mod. 65 hp	3613 cm^3
- mod. 75 hp	3908 cm^3
- mod. 85 hp	3908 cm^3
- mod. 95 hp	3908 cm^3
Compression ratio	17 to 1 normally aspirated 16.5 to 1 turbocharged
Maximum power:	
- mod. 65 hp	48 kW (65 hp)
- mod. 75 hp	56 kW (75 hp)
- mod. 85 hp	63 kW (85 hp)
- mod. 95 hp	70 kW (95 hp)
Max. power speed	2500 rpm
Max. torque speed: 65 hp model	1400 rpm
Max. torque speed: 75 hp model	1400 rpm
Max. torque speed: 85 hp model	1500 rpm
Max. torque speed: 95 hp model	1500 rpm
Number of main bearings	5
Sump pan	Structural, cast iron

(continued)

GENERAL SPECIFICATIONS	4-cylinder
Lubrication	forced, with gear pump
Pump drive	camshaft
Engine speed/oil pump speed ratio	2:1
Oil cleaning	mesh screen on oil pick-up and filter cartridge in delivery line
Normal oil pressure, warm engine running at max. speed:	2.9 to 3.9 bar (42 to 57 psi)
Pressure relief valve	built into pump housing
Valve opening pressure	3.5 bar (51 psi)
For further lubrication data	See page 2-22
Cooling system	water circulation
Radiator on 65 hp and 75 hp models	3-row vertical pipes with copper fins
Radiator on 85 hp and 95 hp models	4-row vertical copper pipes
Fan, attached to coolant pump pulley	6-blade steel exhauster fan
Coolant pump	centrifugal vane-type
Engine speed/coolant pump speed ratio	1:1.403
Temperature control	Thermostat
Coolant thermometer	coloured scale divided into 3 sections
Temperature ranges corresponding to each section:	
- initial white section	30° to 65° C (86° to 149° F)
- middle green section	65° to 105° C (149° to 221° F)
- final red section	105° to 115° C (221° to 239° F)
For further cooling system data	See page 2-22
Rev counter	incorporated in control panel
Drive	from gear on camshaft
Hour counter calibrated for engine speed of	1800 rpm

(continued)

GENERAL SPECIFICATIONS	4-cylinder
Timing	overhead valves operated camshaft located in engine block through tappets, pushrods and rockers; camshaft is driven by the crankshaft through helical gears.
Inlet:	
- start: before TDC	12°
- end: after BDC	31°
Exhaust:	
- start: before BDC	50°
- end: after TDC	16°
Valve clearance for timing check	0.45 mm (0.0177 in.)
Valve clearance for normal running (engine cold):	
- inlet	0.30 to 0.05 mm (0.0118 to 0.0020 in.)
- exhaust	0.30 to 0.05 mm (0.0118 to 0.0020 in.)
For further timing data	See page 2-19
Fuel system	
Air cleaning	dual cartridge dry air filter, with clogged filter indicator with centrifugal pre-filter and automatic dust ejector
Fuel supply pump	double diaphragm
Fuel filtering	through wire filter in fuel supply pump, and replaceable cartridge on delivery line to injection pump.
Minimum fuel flow rate with pump shaft rotating at 1600 rpm	100 litres/hour (26.4 US gal/hr)
Operated by eccentric cam	on camshaft
BOSCH injection pump	distributor type
All-speed governor, incorporated in pump:	
BOSCH	centrifugal counterweights
Automatic advance regulator, incorporated in pump:	
BOSCH	hydraulic
For further fuel system data:	
For fixed advance (pump setting for start of delivery before TDC) - Pressure setting - Injection order, and other information regarding the BOSCH pump	refer to the data for the relevant engine type in the table on page 2-3

FUEL SYSTEM DATA

Turbocharger (models 85 hp, 95 hp):	
- GARRETT type	TA 3118-0.82 A/R-57
Injection pump	distributor type with incorporated speed governor and automatic advance regulator
BOSCH pump:	
- 65 hp model	VE 4/11 F 1250 L 164-2 - 4804869
- 75 hp model	VE 4/11 F 1250 L 613-1 - 99441847
- 85 hp model	VE 4/11 F 1250 L 613 - 99436544
- 95 hp model	VE 4/11 F 1250 L 678 - 99449527
Direction of rotation	counter-clockwise
Injection order	1-3-4-2

	65 hp	75 hp	85 hp	95 hp
Injectors:				
BOSCH	4792442	4800029	4824170	99469340
- Nozzle holder type	4791124	4791124	4791124	4791124
- Nozzle type	4792443	4800030	4824171	99469341
OMAP				
- Nozzle holder type	4796644	-	-	-
- Nozzle type	4792447	-	-	-
STANADYNE	4802391	4802394	99431239	-
- Nozzle holder type	4802392	4802392	4802392	-
- Nozzle type	4802393	4802395	99431240	-
Number of nozzles	4	3	3	5
Diameter of nozzle orifices ..... mm (in.)	0.31 (0.12 in.)	0.35 (0.14 in.)	0.35 (0.14 in.)	0.23 (0.09 in.)
Pressure setting ..... bar	230-242 (3335 - 3510 psi)	230-242 (3335 - 3510 psi)	260-272 (3770 - 3940 psi)	260-272 (3770 - 3940 psi)
Fuel delivery lines - BOSCH pump				
- type	4797516	4797516	99436547	99449006
- Dimensions ..... mm	6x1.5x530	6x1.5x530	6x1.75x530	6x1.75x530

65 hp MODEL - CALIBRATION DATA FOR BOSCH INJECTION PUMP TYPE VE 4/11 F 1250 L 164-2

ASSEMBLY DATA

Pump timing on engine: delivery start 4° ± 1° before TDC of cylinder 1 compression stroke.
Plunger pre-lift for timing on engine: 1 mm (0.0394 in.) from BDC (with tools **291754 - 291755**).
Cylinder n. 1 delivery line union on pump: marked with letter A.

ASSEMBLY DIMENSIONS

SYMBOL	SVS (max)	KF	MS	ya	yb
mm	4.30	5.00-5.40	1.40-1.80	37.9-39.9	44.2-49.6

CALIBRATION TEST CONDITIONS

Test bench conforming to ISO 4008/1.../2
Injectors conforming to ISO 7440-A61 - (1688901020 with pad diameter(∅) 0.6 mm [0.0236 in.])
Injector pressure setting: 172 to 175 bar (2490 to 2540 psi).
Supply pressure: 0.35 ± 0.05 bar (5.1 ± 0.7 psi).
Delivery pipes (conforming to ISO 4093.2):
6 x 2 x 840 mm
Graduate drain time: 30 sec.
Test liquid: ISO 4113 at a temperature of 45° ± 1°C (113° ± 33.8°F).

1. START OF DELIVERY

Plunger pre-lift from TDC: mm 0.2 ± 0.02 (0.04) in. 0.0080 ± 0.0008 (0.0016)	Pump rotation (viewed from drive side): counter-clockwise	Injection order: 1-3-4-2

2. ADVANCE REGULATOR STROKE

Rpm: 800	Advance stroke: 3.0 ± 3.4 mm

3. FUEL SUPPLY PUMP PRESSURE

Rpm: 800	Internal pressure: 4.1 ± 4.7 bar

4. FULL-LOAD DELIVERY

Rpm: 750	Delivery per 1000 shots 62 ± 63 cm^3	Spread: ≤ 4.0 (4.0) cm^3

5. SPREAD GOVERNOR AT IDLE SPEED

Rpm: 350	Delivery per 1000 shots: 21 ± 25 cm^3	Spread: ≤ 3.5 (3.5) cm^3

6. SPREAD GOVERNOR AT MAX. SPEED

Rpm: 1350	Delivery per 1000 shots: 43 ± 7 cm^3	Spread: - cm^3

7. DELIVERY AT STARTING

Rpm: 100	Delivery per 1000 shots: 80 to 140 cm^3

8. TRANSFER PRESSURE PROGRESSION

Rpm		600	800	1250
Internal supply pressure	bar	3.2 to 3.8	4.1 to 4.7	6.1 to 6.7

9. INJECTION ADVANCE PROGRESSION

Rpm		600	800	1000
Advance stroke	mm	1.2 to 2.0 (0.9 to 2.3)	3.0 to 3.4 (2.5 to 3.9)	5.4 to 6.2 (5.1 to 6.5)

10. BACKFLOW

Rpm		500	1250
Backflow	cm^3 /10 sec	41.7 to 83.4 (26.7 to 98.4)	55.6 to139 (40.6 to 153)

(continued)

Note: the values shown above in brackets must be used for checking purposes only.

11. DELIVERY PROGRESSION

Rpm	Delivery per 1000 shots: cm^3
1450	1.5 (0 to 3)
1400	8 to 18 (5 to 21)
1350	43 to 47 (39 to 51)
1250	52 to 55 (50 to 57)
750	62 to 63 (59.5 to 65.5)
500	57 to 61 (55.5 to 62.5)

12. DELIVERY CHECK AT IDLE SPEED

Rpm		350	450
Delivery per 1000 shots:	cm^3	21 to 25 (19 to 27)	0 to 2.0

Note: the values shown above in brackets must be used for checking purposes only.

13. MECHANICAL ZERO CAPACITY (STOP)

rpm	Voltage (volt)	Delivery per 100 shots: cm^3
1250	12	0 to 3

14. ELECTRICAL ZERO CAPACITY (STOP)

rpm	Voltage (volt)	Delivery per 100 shots: cm^3
350	12	0 to 3

15. AUTOMATIC START CAPACITY SUPPLEMENT

rpm	Delivery per 100 shots: cm^3
100	90 to 140
250	30 to 50
150	100 to 150

BENCH TEST PERFORMANCE DATA

Test conditions

Fixed advance before TDC cylinder No. 1 in compression stroke: (see previous page)

Engine without fan, air filter and exhaust silencer.

Atmospheric pressure: 740 ± 5mm (29.13 ± 0.20 in.) Hg (at altitude of Turin).

Relative humidity 70% ± 5.

Ambient temperature 20 ± 3° C (68 ± 5°F).

Specific gravity of diesel fuel 830 ± 10 g/litre.

Throttle lever position	Braking load applied	Engine speed rpm	Power output with engine run-in for a total of: 2 hours kW (hp)	Power output with engine run-in for a total of: 50 hours kW (hp)	Fuel consumption kg/h
Maximum	For maximum power output	2500	≥ 46.3 (63)	47.8 to 49.6 (65 to 67.5)	11 to 11.4
Maximum	For maximum torque	1500	≥ 31.8 (43)	32.8 to 34.9 (44.6 to 47.6)	7.1 to 7.6
Maximum	None (no-load)	2750 to 2790	-	-	-
Minimum	None (no-load)	625 to 675	-	-	-

75 hp MODEL - CALIBRATION DATA FOR BOSCH INJECTION PUMP TYPE VE 4/11 F 1250 L 613-1

ASSEMBLY DATA

Pump timing on engine: delivery start 7° ± 0.5° before TDC of cylinder 1 compression stroke.
Plunger pre-lift for timing on engine: 1 mm (0.0394 in.) (from BDC (with tools **291754 - 291755**)
Cylinder n. 1 delivery line union on pump: marked with letter A.

ASSEMBLY DIMENSIONS

SYMBOL	SVS (max)	KF	MS	ya	yb
mm	4.6	5.3-5.7	1.4-1.8	37.9-39.9	44-44.1

CALIBRATION TEST CONDITIONS

Test bench conforming to ISO 4008/1.../2.
Injectors conforming to ISO 7440-A61 - (1688901027 with pad diameter(∅) 0,5 mm).
Injector pressure setting: 172 to 175 bar (2490 to 2540 psi).
Supply pressure: 0.35 ± 0,05 bar (5.1 ± 0.7 psi).
Delivery pipes (conforming to ISO 4093.2): 6 x 2 x 840 mm (0.236 x 0.079 x 33.070 in.).
Graduate drain time: 30 sec.
Test liquid: ISO 4113 at a temperature of 44° ± 4°C (111° ± 39°F).

1. START OF DELIVERY

Plunger pre-lift from TDC: mm 0.2 ± 0.02 (0.04) in. 0.0080 ± 0.0008 (0.0016)	Pump rotation (viewed from drive side): counter-clockwise	Injection order: 1-3-4-2

2. ADVANCE REGULATOR STROKE

Rpm: 800	Advance stroke: 3.1 to 3.5 mm

3. FUEL SUPPLY PUMP PRESSURE

Rpm: 800	Internal pressure: 4.7 to 5.3 bar

4. FULL-LOAD DELIVERY

Rpm: 750	Delivery per 1000 shots 62 ± 63 cm^3	Spread: ≤ 5 (4.0) cm^3

5. SPREAD GOVERNOR AT IDLE SPEED

Rpm: 350	Delivery per 1000 shots: 21 ± 25 cm^3	Spread: ≤ 3.5 (3.5) cm^3

6. SPREAD GOVERNOR AT MAX. SPEED

Rpm: 1350	Delivery per 1000 shots: 43 ± 7 cm^3	Spread: - cm^3

7. DELIVERY AT STARTING

Rpm: 100	Delivery per 1000 shots: 65 to 115 cm^3

8. TRANSFER PRESSURE PROGRESSION

Rpm		800	550	1250
Internal supply pressure	bar	4.7 to 5.3	3.2 to 3.8	6.9 to 7.5

9. INJECTION ADVANCE PROGRESSION

Rpm		800	500	1250
Advance stroke	mm	3.1 to 3.5	0.2 to 1.0 (0 to 1.3)	6.9 to 7.5 (6.5 to 7.9)

10. BACKFLOW

Rpm		400	1250
Backflow	cm^3	41.6 to 86.1 (26.6 to 101)	55 to138 (40 to 153)

(continued)

Note: the values shown above in brackets must be used for checking purposes only.

11. DELIVERY PROGRESSION

Rpm	Delivery per 1000 shots: cm^3
1450	0 to 3
1400	5 to 21
1350	37 to 41
1250	50 to 54 (48.5 to 55.5)
750	52.5 to 53.5 (50 to 56)
400	48.5 to 51.5 (46.5 to 53.5)

12. DELIVERY CHECK AT IDLE SPEED

Rpm		325	250	400
Delivery per 1000 shots:	cm^3	16 to 20	32 to 36	0 to 2.0

(*) Turn LDA spring preloading adjuster nut. LDA stroke: 4.7 to 5.7 mm (0.1850 to 0.2244 in.).

13. MECHANICAL ZERO CAPACITY (STOP)

rpm	Volatge (volt)	Delivery per 100 shots: cm^3
1250	12	0 to 3

14. ELECTRICAL ZERO CAPACITY (STOP)

rpm	Volatge (volt)	Delivery per 100 shots: cm^3
350	12	0 to 3

15. AUTOMATIC START CAPACITY SUPPLEMENT

rpm	Delivery per 100 shots: cm^3
100	65 to 115
250	40 to 60
150	75 to 125

BENCH TEST PERFORMANCE DATA

Test conditions

Fixed advance before TDC cylinder No. 1 in compression stroke: (see previous page)

Engine without fan, air filter and exhaust silencer.

Atmospheric pressure: 740 ± 5mm (29.13 ± 0.20 in.) Hg (at altitude of Turin).

Relative humidity 70% ± 5.

Ambient temperature 25 °C (77 °F).

Specific gravity of diesel fuel 830 ± 10 g/litre.

Throttle lever position	Braking load applied	Engine speed rpm	Power output with engine run-in for a total of: 2 hours kW (hp)	Power output with engine run-in for a total of: 50 hours kW (hp)	Fuel consumption kg/h
Maximum	For maximum power output	2500	≥ 52.6 (71.5) (*)	54.5 to 56.5 (74 to 77)	12.6 to 13.1
Maximum	For maximum torque	1500	≥ 36.4 (49.5) (*)	37.5 to 39.7 (51 to 54)	8.15 to 8.56
Maximum	None (no-load)	2750 to 2790	-	-	-
Minimum	None (no-load)	625 to 675	-	-	-

(*) Expected values.

85 hp MODEL - CALIBRATION DATA FOR BOSCH INJECTION PUMP TYPE VE 4/11 F 1250 L 613

ASSEMBLY DATA

Pump timing on engine: delivery start 7° ± 0.5° before TDC of cylinder 1 compression stroke.
Plunger pre-lift for timing on engine: 1 mm from BDC (with tools **291754 - 291755**).
Cylinder n. 1 delivery line union on pump: marked with letter A.

ASSEMBLY DIMENSIONS

SYMBOL	K	KF	MS	SVS (max)	ya	yb
mm	3.2-3.4	5.30	0.6-1.0	6.0	36.5-38.5	43.9-49.1

CALIBRATION TEST CONDITIONS

Test bench conforming to ISO 4008/1.../2
Injectors conforming to ISO 7440-A61 - (1688901027 with pad diameter(∅) 0,5 mm)
Injector pressure setting: 250 to 253 bar (3625 to 3665 psi).
Supply pressure: 0.35 ± 0.05 bar (5.1 ± 0.7 psi).
Delivery pipes (conforming to ISO 4093.2): 6 x 2 x 840 mm
Graduate drain time: 30 sec.
Test liquid: ISO 4113 at a temperature of 44° ± 4°C (111° ± 39°F).

1. START OF DELIVERY

Plunger pre-lift from TDC: mm 0	Pump rotation (viewed from drive side): counter-clockwise	Injection order: 1-3-4-2

2. ADVANCE REGULATOR STROKE

Rpm: 800	Advance stroke: 3.1 to 3.5 mm

3. FUEL SUPPLY PUMP PRESSURE

Rpm: 800	Internal pressure: 4.7 to 5.3 bar

4. FULL-LOAD DELIVERY

Rpm: -	Delivery per 1000 shots 62 ± 63 cm^3	Spread: ≤ 5 (4.0) cm^3

5. SPREAD GOVERNOR AT IDLE SPEED

Rpm: 800	Delivery per 1000 shots: 21 ± 25 cm^3	Spread: ≤ 3.5 (3.5) cm^3

6. SPREAD GOVERNOR AT MAX. SPEED

Rpm: 325	Delivery per 1000 shots: 43 ± 7 cm^3	Spread: - cm^3

7. DELIVERY AT STARTING

Rpm: 1325	Delivery per 1000 shots: 65 to 115 cm^3

8. DELIVERY AT STARTING

Rpm: 100	Delivery per 1000 shots: 65 to 115 cm^3

9. TRANSFER PRESSURE PROGRESSION

LDA pressure	kPa	-		
Rpm		400	800	1250
Internal supply pressure	bar	3.7 to 4.3	5.7 to 6.3	7.7 to 8.3

10. INJECTION ADVANCE PROGRESSION

LDA pressure	kPa	-		
Rpm		700	800	1150
Advance stroke	mm	1.76 to 1.84 (1.1 - 2.5)	2.5 to 2.9 (2.3 to 3.1)	6.0 to 6.8 (5.7 to 7.1)

11. BACKFLOW

Rpm		500	1250
LDA pressure	kPa	-	-
Backflow	cm^3	41.6 to 86.1 (26.6 to 101)	55 to138 (40 to 153)

(continued)

Note: the values shown above in brackets must be used for checking purposes only.

12. DELIVERY PROGRESSION

Rpm	LDA pressure kPa	Delivery per 1000 shots: cm^3
1420	-	0 to 3
1325	-	43 to 47 (39 to 51)
1300	-	53.5 to 57.5 (50.5 to 60.5)
1250	-	58 to 61 (55.5 to 63.5)
800	-	67 to 68 (65 to 70)
400	-	67.5 to 70.5 (66.5 to 71.5)

13. DELIVERY CHECK AT IDLE SPEED

Rpm		325	250	400
Delivery per 1000 shots cm^3	cm^3	16 to 20	32 to 36	0 to 2.0

Note: the values shown above in brackets must be used for checking purposes only.

14. MECHANICAL ZERO CAPACITY (STOP)

rpm	Voltage (volt)	Delivery per 100 shots: cm^3
1250	12	0 to 3

15. ELECTRICAL ZERO CAPACITY (STOP)

rpm	Voltage (volt)	Delivery per 100 shots: cm^3
325	12	0 to 3

16. AUTOMATIC START CAPACITY SUPPLEMENT

rpm	LDA pressure kPa	Delivery per 100 shots: cm^3
100	-	65 to 115
250	-	45 to 75
150	-	75 to 125

BENCH TEST PERFORMANCE DATA

Test conditions

Fixed advance before TDC cylinder No. 1 in compression stroke: (see previous page)

Relative humidity 70% ± 5.

Engine without fan, air filter and exhaust silencer.

Ambient temperature 25 °C (77 °F).

Atmospheric pressure: 740 ± 5mm (29.13 ± 0.20 in.) Hg (at altitude of Turin).

Specific gravity of diesel fuel 830 ± 10 g/litre.

Throttle lever position	Braking load applied	Engine speed rpm	Power output with engine run-in for a total of: 2 hours kW (hp)	Power output with engine run-in for a total of: 50 hours kW (hp)	Fuel consumption kg/h
Maximum	For maximum power output	2500	≥ 60.6 (82.5)	61.8 to 64 (84 to 87)	13.9 to 14.7
Maximum	For maximum torque	1500	≥ 43.5 (59.2)	44.4 to 48 (60.4 to 65.2)	9.4 to 10
Maximum	None (no-load)	2750 to 2790	-	-	-
Minimum	None (no-load)	625 to 675	-	-	-

95 hp MODEL - CALIBRATION DATA FOR BOSCH INJECTION PUMP TYPE VE 4/11 F 1250 L 678

ASSEMBLY DATA

Pump timing on engine: delivery start 7° ± 0.5° before TDC of cylinder 1 compression stroke.
Plunger pre-lift for timing on engine: 1 mm from BDC (with tools **291754 - 291755**)
Cylinder n. 1 delivery line union on pump: marked with letter A.

ASSEMBLY DIMENSIONS

SYMBOL	K	MS	ya	yb
mm	3.2-3.4	0.90-1.30	34.9-36.9	47.3-52.5

CALIBRATION TEST CONDITIONS

Test bench conforming to ISO 4008/1.../2
Injectors conforming to ISO 7440-A61 - (1688901020 with pad diameter(∅) 0,5 mm)
Injector pressure setting: 250 to 253 bar (3625 to 3665 psi).
Supply pressure: 0.35 ± 0.05 bar (5.1 ± 0.7 psi).
Delivery pipes (conforming to ISO 4093.2): 6 x 2 x 840 mm
Graduate drain time: 30″
Test liquid: ISO 4113 at a temperature of 45° ± 1°C (113° ± 33.8°F).

1. START OF DELIVERY

Plunger pre-lift from TDC: mm 0	Pump rotation (viewed from drive side): counter-clockwise	Injection order: 1-3-4-2

2. ADVANCE REGULATOR STROKE

Rpm: 850	Advance stroke: 1.7 to 2.1 mm

3. FUEL SUPPLY PUMP PRESSURE

Rpm: 850	Internal pressure: 6.3 to 6.9 bar

4. FULL-LOAD DELIVERY

Rpm: 750	LDA pressure: kPa 100	Delivery per 1000 shots 74 to 75 cm^3	Spread: ≤ 3.5 (4.0) cm^3

5. FULL-LOAD DELIVERY

Rpm: 500	Delivery per 1000 shots 63 to 64 cm^3

6. SPREAD GOVERNOR AT IDLE SPEED

Rpm: 325	Delivery per 1000 shots: 8 to 12 cm^3	Spread: ≤ 3.5 (3.5) cm^3

7. SPREAD GOVERNOR AT MAX. SPEED

Rpm: 1360	LDA pressure: kPa 100	Delivery per 1000 shots: 17.5 to 27.5 cm^3

8. DELIVERY AT STARTING

Rpm: 100	Delivery per 1000 shots: 80 to 120 cm^3

9. TRANSFER PRESSURE PROGRESSION

LDA pressure	kPa	100		
Rpm		850	1050	1200
Internal supply pressure	bar	6.3 to 6.9	7.4 to 8.0	8.2 to 8.8

10. INJECTION ADVANCE PROGRESSION

LDA pressure	kPa	100		
Rpm		850	1050	1200
Advance stroke	mm	1.7 to 2.1 (1.2 to 2.6)	3.3 to 4.1	4.4 to 5.2 (4.1 to 5.5)

11. BACKFLOW

Rpm		350	1250
LDA pressure	kPa	100	100
Backflow	cm^3	46.9 to 85.5 (31.9 to 70.5)	55 to138 (40 to153)

(continued)

Note: the values shown above in brackets must be used for checking purposes only.

12. DELIVERY PROGRESSION

Rpm	LDA pressure kPa	Delivery per 1000 shots: cm^3
500	25 (*)	63 to 64 (60.5 to 66.5)
1410	100	0 to 3 (0 to 3)
1360	100	17 to 27 (16 to 28)
1330	100	57 to 63 (52 to 68)
1250	100	62 to 65 (60 to 67)
750	100	74 to 75 (71.5 to 77.5)
500	0	51.5 to 53 (49 to 55)
350	100	78.5 to 81.5 (76.5 to 83.5)

13. DELIVERY CHECK AT IDLE SPEED

Rpm		335	400	250
Delivery per 1000 shots:	cm^3	8 to12 (6 to14)	0 to 3	27 to 33 (25 to 35)

(*) Turn the LDA spring pre-charge adjuster ring nut. LDA travel 4.2 - 6.2 mm (0.1654 - 0.2440 in.)

Note: the values shown above in brackets must be used for checking purposes only.

14. MECHANICAL ZERO CAPACITY (STOP)

rpm	Voltage (volt)	Delivery per 100 shots: cm^3
335	-	0 to 3

15. AUTOMATIC START CAPACITY SUPPLEMENT

rpm	LDA pressure kPa	Delivery per 100 shots: cm^3
100	-	80 to 120
250	-	43 to 73
130	-	82 to 132

BENCH TEST PERFORMANCE DATA

Test conditions

Fixed advance before TDC cylinder No. 1 in compression stroke: (see previous page)

Engine without fan, air filter and exhaust silencer.

Atmospheric pressure: 740 ± 5mm (29.13 ± 0.20 in.) Hg (at altitude of Turin).

Relative humidity 70% ± 5.

Ambient temperature 25 °C (77 °F).

Specific gravity of diesel fuel 830 ± 10 g/litre.

Throttle lever position	Braking load applied	Engine speed rpm	Power output with engine run-in for a total of: 2 hours kW (hp)	Power output with engine run-in for a total of: 50 hours kW (hp)	Fuel consumption kg/h
Maximum	For maximum power output	2500	≥ 66.5 (90.5)	68 to 72 (92.5 to 98.5)	15.5 to 16.5
Maximum	For maximum torque	1500	-	50.8 to 54 (69.2 to 73.2)	11 to 11.6
Maximum	None (no-load)	2725 to 2775	-	-	-
Minimum	None (no-load)	625 to 675	-	-	-

FUEL SUPPLY PUMP DATA	mm (Inches)
Eccentricity of drive shaft	3
Diameter of drive shaft at bushings	31.975 to 32.000 (1.2589 to 1.2598 in.)
Internal diameter of installed and reamed bushings	32.050 to 32.075 (1.2618 to 1.2628 in.)
Interference between bushings and seats	0.063 to 0.140 (0.0025 to 0.0055 in.)
Assembly clearance between shaft and bushings	0.050 to 0.100 (0.0020 to 0.0039 in.)
Thickness of internal washer	1.45 to 1.50 (0.0571 to 0.0591 in.)
Thickness of external washer	2.93 to 3.00 (0.1153 to 0.1181 in.)

CRANKCASE/CYLINDER BLOCK DATA	mm (Inches)	
	100 mm bore (3.937 in.)	104 mm bore (4.094 in.)
Cylinder block	cast-iron monobloc with replaceable dry-fitted cylinder liners, incorporating seatings for crankshaft bearings, camshaft and pushrod/tappet assemblies	
Internal diameter of cylinder liners	100.000 to 100.024 (1) (3.9370 to 3.9379 in.)	104.000 to 104.024 (1) (4.0945 to 4.0954 in.)
External diameter of cylinder liners	103.020 to 103.050 (4.0559 to 4.0571 in.)	107.020 to 107.050 (4.2134 to 4.2146 in.)
Diameter of cylinder bores	102.850 to 102.900 (4.0492 to 4.0512 in.)	106.850 to 106.900 (4.2067 to 4.2087 in.)
Interference fit between cylinder liners and bores	0.120 to 0.200 (0.0047 to 0.0079 in.)	
Liner internal diameter oversizes	0.4 to 0.8 (0.0157 to 0.0315 in.)	
Liner external diameter oversizes	0.2 (0.0079 in.)	
Maximum permissible liner ovality or taper due to wear (2)	0.12 (0.0047 in.)	
Diameter of main shell bearing seats	84.200 to 84.230 (3.3150 to 3.3161 in.)	
Diameter of camshaft bearing seats:		
- front	54.780 to 54.805 (2.1567 to 2.1577 in.)	
- center	54.280 to 54.305 (2.1370 to 2.1380 in.)	
- rear	53.780 to 53.805 (2.1173 to 2.1183 in.)	
Diameter of standard tappet bores in crankcase	15.000 to 15.018 (0.5906 to 0.5913 in.)	
Tappet oversizes	0.1 - 0.2 - 0.3 (0.004 - 0.008 - 0.0012 in.)	

(1) Measured after press-fitting and reaming.
(2) Measure in the area swept by piston rings, both parallel and perpendicular to the crankshaft axis.

CRANKSHAFT AND BEARINGS DATA	mm	
	100 mm bore (3.937 in.)	104 mm bore (4.094 in.)
Crankshaft	balanced with integral counterweights	
Standard journal diameter	79.791 to 79.810 (1) (3.1414 to 3.1421 in.)	
Journal undersizes	0.254 - 0.508 - 0.762 - 1.016 (0.0100 - 0.0200 - 0.0300 - 0.0400 in.)	
Standard main bearing shell thickness	2.168 to 2.178 (0.0854 to 0.0857 in.)	
Main bearing shell undersizes (internal diameter)	0.254 - 0.508 - 0.762 - 1.016 (0.0100 - 0.0200 - 0.0300 - 0.0400 in.)	
Bearing shell to journal clearance	0.034 to 0.103 (0.0013 to 0.0041 in.)	
Maximum permitted wear clearance	0.180 (0.0071 in.)	
Standard crankpin diameter	63.725 to 63.744 (1) (2.5089 to 2.5096 in.)	
Crankpin undersizes	0.254 - 0.508 - 0.762 - 1.016 (0.0100 - 0.0200 - 0.0300 - 0.0400 in.)	
Standard big-end bearing shell thickness	1.805 to 1.815 (0.0711 to 0.0715 in.)	
Big-end bearing shell undersizes (internal diameter)	0.254 - 0.508 - 0.762 - 1.016 (0.0100 - 0.0200 - 0.0300 - 0.0400 in.)	
Big-end bearing shell to crankpin clearance	0.033 to 0.087 (0.0013 to 0.0034 in.)	
Maximum permitted wear clearance	0.180 (0.0071 in.)	
Standard crankshaft thrust washer thickness	3.378 to 3.429 (0.1330 to 0.1350 in.)	
Thrust washer oversizes (thickness)	0.127 - 0.254 - 0.381 - 0.508 (0.0050 - 0.0100 - 0.0150 - 0.0200 in.)	
Width of main bearing including thrust washers	31.766 to 31.918 (1.2506 to 1.2566 in.)	
Width of corresponding crankshaft journal	32.000 to 32.100 (1.2598 to1.2638 in.)	
Crankshaft assembly endfloat	0.082 to 0.334 (0.0032 to 0.0132 in.)	
Max. permitted wear endfloat	0.40 (0.0158 in.)	
Maximum ovality or taper of journals and crankpin after regrinding	0.01 (0.004 in.)	
Maximum ovality or taper of worn journals and crankpin	0.05 (0.0020 in.)	
Maximum tolerance for alignment of crankshaft journals with crankshaft supported on the two outer journals	0.10 (0.0040 in.)	
Maximum tolerance for alignment, in both directions, of crankpins (3-cylinder engines) or each pair of crankpins (4-cylinder engines) relative to crankshaft journals	0.25 (0.0100 in.)	
Maximum tolerance for run-out between the outer surfaces of the crankshaft journals and the crankshaft centerline	± 0.10 (± 0.0040 in.)	

(continued)

(1) Crankshafts with 0.1 mm (0.0039 in.) undersize journals and crankpins and consequently undersize bearing shells may be fitted in factory production.

CRANKSHAFT AND BEARINGS DATA	mm (Inches)	
	100 mm bore (3.937 in.)	104 mm bore (4.094 in.)
Maximum permitted tolerance on run-out of flywheel mounting flange surface relative to the crankshaft centerline, measured with 1/100 mm scale dial gauge resting on front flange surface (A, page 2-79) at a diameter of 108 mm (total gauge reading).	0.025 (0.0010 in.)	
Maximum permitted tolerance on co-axial alignment of flywheel centering seat (B, page 2-79) relative to the crankshaft journals (total gauge reading)	0.040 (0.0016 in.)	

CONNECTING ROD DATA	mm (Inches)	
	100 mm bore (3.937 in.)	104 mm bore (4.094 in.)
Connecting rods	cast-iron with oil way	
Diameter of small end bushing seat	41.846 to 41.884 (1.6475 to 1.6490 in.)	
Outside diameter of small end bushing	41.979 to 42.017(1.6527 to 1.6542 in.)	
Interference between small end bushing and seat	0.095 to 0.171 (0.0037 to 0.0067 in.)	
Inside diameter of small end bushing (measured after fitting)	38.004 to 38.014 (1.4962 to 1.4965 in.)	
Diameter of big end shell bearing seats	67.407 to 67.422 (2.6538 to 2.6544 in.)	
Max. tolerance for parallelism between the small end and big end axes measured at 25 mm (0.98 in.)	± 0.07 (± 0.0028 in.)	
Max. weight difference between con rods in same engine	25 grams (0.9 oz.)	

PISTON DATA	mm (Inches)	
	100 mm bore (3.937 in.)	**104 mm bore (4.094 in.)**
Pistons	Light alloy with two compression and one oil control rings	
Standard piston diameter, measured at 57 mm from base from skirt and perpendicularly to the gudgeon pin axis	99.827 to 99.841 (3.9302 to 3.9307 in.)	103.812 to 103.826 (4.0871 to 4.0876 in.)
Piston clearance in cylinder liner	0.159 to 0.197 (0.0063 to 0.0078 in.)	0.174 to 0.212 (0.0069 to 0.0084 in.)
Max. permissible clearance due to wear	0.30 (0.0118 in.)	
Piston oversizes	0.4 and 0.8 (0.0158 and 0.0315 in.)	
Piston protrusion at TDC from cylinder block face	0.355 to 0.761 (0.0140 to 0.0300 in.)	
Gudgeon pin diameter	37.983 to 37.990 (1.4955 to 1.4957 in.)	
Diameter of gudgeon pin seat in piston	37.993 to 8.000 (1.4958 to 1.4961 in.)	
Gudgeon pin to seat clearance	0.003 to 0.017(0.0001 to 0.0007 in.)	
Gudgeon pin to small end bearing clearance	0.014 to 0.031 (0.0005 to 0.0012 in.)	
Max. permissible clearance due to wear	0.06 (0.0024 in.)	
Max. weight difference between pistons in same engine	20 grams (0.7 oz.)	
Piston ring groove clearance (measured vertically):		
- Top	0.090 to 0.122 (0.0035 to 0.0048 in.)	
- Second	0.060 to 0.092 (0.0024 to 0.0036 in.)	
- Bottom	0.040 to 0.075 (0.0016 to 0.0030 in.)	
Max. permissible clearance (wear limit):		
- Top	0.50 (0.0197 in.)	
- Second and bottom	0.20 (0.0079 in.)	
Piston ring end gap (fitted):		
- Top	0.35 to 0.55 (0.0138 to 0.0217 in.)	0.40 to 0.65 (0.0157 to 0.0256 in.)
- Second	0.30 to 0.45 (0.0118 to 0.0177 in.)	0.30 to 0.55 (0.0118 to 0.0217 in.)
- Bottom	0.30 to 0.60 (0.0118 to 0.0236 in.)	
Max. permissible gap (wear limit)	1.20 (0.0472 in.)	

VALVE TIMING GEAR DATA	mm (Inches)	
	100 mm bore (3.937 in.)	104 mm bore (4.094 in.)
Timing gear tooth backlash	0.160 (0.0063 in.)	
Inside diameter of intermediate gear bushings (fitted and reamed)	37.050 to 37.075 (1.4587 to 1.4596 in.)	
Diameter of intermediate gear journal	36.975 to 37.000 (1.4557 to 1.4567 in.)	
Journal to bushing clearance	0.050 to 0.100 (0.0020 to 0.0040 in.)	
Max. permissible clearance (wear limit)	0.15 (0.0060 in.)	
Busing interference fit in seat in intermediate gear	0.063 to 0.140 (0.0025 to 0.0055 in.)	
Outside diameter of camshaft bearings:		
- front	54.875 to 54.930 (2.1604 to 2.1626 in.)	
- center	54.375 to 54.430 (2.1407 to 2.1429 in.)	
- rear	53.875 to 53.930 (2.1210 to 2.1232 in.)	
Interference between bearings and seats in cylinder block	0.070 to 0.150 (0.0028 to 0.0039 in.)	
Inside diameter of camshaft bearings (fitted and reamed):		
- front	51.080 to 51.130 (2.0110 to 2.0123 in.)	
- center	50.580 to 50.630 (1.9913 to 1.9933 in.)	
- rear	50.080 to 50.130 (1.9716 to 1.9736 in.)	
Diameter of camshaft journals:		
- front	50.970 to 51.000 (2.0067 to 2.0079 in.)	
- center	50.470 to 50.500 (1.9842 to 1.9881 in.)	
- rear	49.970 to 50.000 (1.9673 to 1.9685 in.)	
Clearance between camshaft journals and bearings	0.080 to 0.160 (0.0031 to 0.0063 in.)	
Max. permissible clearance (wear limit)	0.20 (0.0079 in.)	
Camshaft endfloat between thrust plate and seat on camshaft	0.070 to 0.220 (0.0028 in 0.0087 in.)	
For further valve timing gear data	see page 2-5	

TAPPET DATA	mm (Inches)	
	100 mm bore (3.937 in.)	104 mm bore (4.096 in.)
Tappet bore in crankcase	15.000 to 15.018 (0.5906 to 0.5913 in.)	
Outside diameter of standard tappet	14.950 to 14.970 (0.5886 to 0.5894 in.)	
Tappet running clearance	0.030 to 0.068 (0.5886 to 0.5894 in.)	
Max. permissible clearance (wear limit)	0.15 (0.0059 in.)	
Tappet oversizes	0.1 - 0.2 - 0.3 (0.0040 - 0.0080 - 0.0120 in.)	

ROCKER ARM - VALVE DATA	mm (Inches)	
	100 mm bore (3.937 in.)	104 mm bore (4.094 in.)
Diameter of shaft bores in rocker arms	18.016 to 18.034 (0.7093 to 0.7100 in.)	
Diameter of rocker arm shaft	17.982 to 18.000 (0.7080 to 0.7087 in.)	
Rocker shaft to rocker arm bore clearance	0.016 to 0.052 (0.0004 to 0.0020 in.)	
Maximum permissible clearance (wear limit)	0.15 (0.0060 in.)	
Rocker arm spacing springs:		
- free length	59.5 (2.3228 in.)	
- length under load of 46 to 52 N (4.7 to 5.3 kg, 10.3 to 11.7 lbs)	44 (1.7323 in.)	
Valve clearance for timing check	0.45 (0.0177 in.)	
Valve clearance for normal running (engine cold):		
- inlet valve	0.30 to 0.05 (0.0118 to 0.0020 in.)	
- exhaust valve	0.30 to 0.05 (0.0118 to 0.0020 in.)	
Cam lift:		
- inlet valve	5.67 (0.2232 in.)	
- exhaust valve	5.95 (0.2343 in.)	

ROTATING COUNTERWEIGHT DYNAMIC BALANCER DATA (Fig. 2-122)	mm (Inches)
Interference fit between bushings (28) and seat in gear (26)	0.063 to 0.140 (0.0025 to 0.0055 in.)
Clearance between intermediate gear journal (27) and bushings (28)	0.050 to 0.100 (0.0020 to 0.0040 in.)
Interference fit between bushings and carrier (20)	0.063 to 0.140 (0.0025 to 0.0055 in.)
Clearance between gear shaft (22) and bushings	0.050 to 0.100 (0.0020 to 0.0040 in.)
Tooth backlash between splined sleeve (17), connecting drive box gear (22) and counterweight drive gear (13)	0.038 to 0.106 (0.0015 to 0.0042 in.)
Interference fit between front bushing (16) and bore in housing (12)	0.063 to 0.140 (0.0025 to 0.0055 in.)
Clearance between counterweight drive shaft (13) and front bushing (16)	0.050 to 0.100 (0.0020 to 0.0040 in.)
Interference fit between rear bushing of counterweight drive gear (13) and seat in carrier (6)	0.037 to 0.101 (0.0015 to 0.0040 in.)
Clearance between counterweight drive shaft (13) and rear bushing	0.013 to 0.061 (0.0005 to 0.0024 in.)
Interference fit between bushing and seat in counterweight (8)	0.040 to 0.100 (0.0016 to 0.0039 in.)
Clearance between counterweight rotation shaft (4) and bushing	0.020 to 0.073 (0.0008 to 0.0029 in.)
Interference fit between intermediate gear bushing (9) and relative seat in housing (12)	0.037 to 0.101 (0.0015 to 0.0040 in.)
Clearance between intermediate gear shaft (9) and relative bushing	0.013 to 0.061 (0.0005 to 0.0024 in.)
Tooth backlash between meshed gears	0.080 (0.0031 in.)