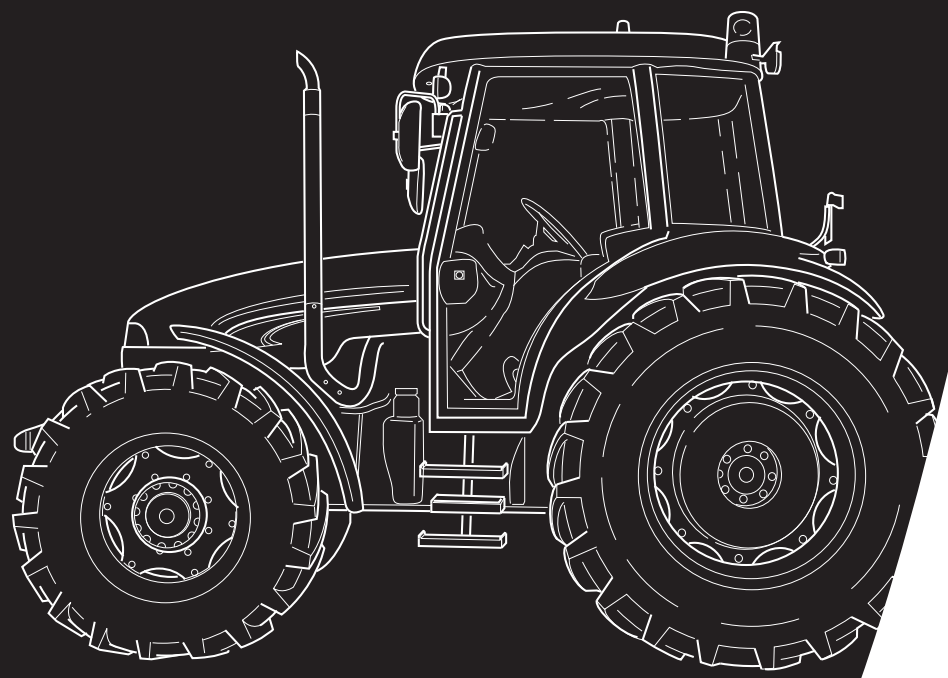
REPAIR MANUAL

NEW HOLLAND
TD60D
TD70D
TD80D
TD90D
TD95D



NEW HOLLAND

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TD60D - TD70D - TD80D - TD90D - TD95D MODEL TRACTORS SERVICE MANUAL

SECTIONS

S E R V I C E

INTRODUCTION

◊ *This manual is divided into sections identified by two-figure numbers. Each section has independent page numbering.*
For ease of reference, these sections have the same numbers and names as the Repairs Rate Book sections.

◊ *The different sections can easily be found by consulting the table of contents on the following pages.*

◊ *The document number of the manual and the edition/update dates are given at the bottom of each page.*

◊ *Pages updated in the future will be identified by the same document number followed by a two-figure update number (for example: 1st update 603.54.471.01; 2nd update 603.54.471.02; etc.) and the corresponding issue date.*
These pages will be supplemented by a reprint of the updated contents page.

◊ *The information contained in this manual was current on the date printed on each section. As NEW HOLLAND constantly improves its product range, some information may be out of date subsequent to modifications implemented for technical or commercial reasons or to meet legal requirements in different countries.*
In the event of conflicting information, consult the NEW HOLLAND Sales and Service Departments.

IMPORTANT WARNINGS

◊ *All maintenance and repair work described in this manual must be performed exclusively by NEW HOLLAND service technicians in strict accordance with the instructions given and using any specific tools necessary.*

◊ *Anyone who performs the operations described herein without strictly following the instructions is personally responsible for resulting injury or damage to property.*

◊ *The Manufacturer and all organisations belonging to the Manufacturer's distribution network, including but not restricted to national, regional or local distributors, will accept no responsibility for personal injury or damage to property caused by abnormal function of parts and/or components not approved by the Manufacturer, including those used for maintenance and/or repair of the product manufactured or marketed by the Manufacturer.*
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NEW HOLLAND

Repair Manual − TD Series Tractors

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GENERAL INSTRUCTIONS

IMPORTANT NOTICE

All maintenance and repair operations described in this manual should be carried out exclusively by the NEW HOLLAND authorised 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 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 no 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 rolling over and twine during mounting which will jeopardise 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 agent: trichlorethylene, petrol or a water and soda solution.

BEARINGS

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

ROLL PINS

When fitting straight roll pins, ensure that the pin notch is oriented in the direction of the effort to stress the pin. Coil roll pins can be installed in any position.

NOTES FOR SPARE PARTS

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

- tractor model (commercial name) and frame number;
- engine type and 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 these 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 prudential rule and safety precautions. 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 machines 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 precautions against accidents.

Careful observance of this only 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 hold into 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 transportation mean, 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 by the forwarder.

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

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

◊ Pay special attention to bystanders.

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

◊ Never use gasoline, diesel oil 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, 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 seat at the operator’s seat and keep the service technician under visual control 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 into your pockets any object which might fall unobserved into the tractor’s inner compartments.

◊ Whenever there is the possibility of being reached by ejected metal parts or similar, use protection 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 the 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, mainly 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 current 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 gases releaved 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. Lack of immediate medical attention, serious infections or dermatosis may result.

◊ Always take system pressure readings using the appropriate gauges.

WHEELS AND TYRES

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

◊ Keep off and stay at the tyre side when correcting the inflation pressure.

◊ Check the pressure only when the tractor is unloaded and tyres 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 tyre 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 in force.

◊ Deflate the tyre before removing any object caught into the tyre tread.

◊ Never inflate tyres using flammable gases 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

COMPONENT TO BE FILLED OR TOPPED UP	QTY dm^3 (litres)	QUANTITY US gal	NEW HOLLAND RECOMMENDED PRODUCT	INTERNATIONAL SPECIFICATION
Cooling system : TD60D, TD70D models TD80D, TD90D, TD95D models . with cab: TD60D, TD70D models TD80D, TD90D, TD95D models .	 12 14 14 16	 3.2 3.7 3.7 4.2	Water & liquid **AMBRA AGRIFLU 50% + 50%** (NH 900 A)	−
Windscreen washer bottle	2	0.5	Water & cleaning liquid	−
Fuel tank	92	24.3	Decanted, filtered diesel fuel	−
Engine sump: without filter: TD60D, TD70D models TD80D, TD90D, TD95D models . with filter TD60D, TD70D models TD80D, TD90D, TD95D models	 6.8 10.7 7.5 11.4	 1.8 2.8 2.0 3.0	**AMBRA Supergold SAE 15W − 40** (NH 330G) **AMBRA Supergold SAE 10W − 30** (NH 324G)	API CF−4/SG CCMC D4 MIL−L−2104E
Brake control circuit	0.4	0.1	**AMBRA BRAKE LHM** Oil **(**NH 610 A)	ISO 7308
Hydrostatic steering circuit	2.0	0.5	Oil **AMBRA MULTI F** (NH 420 A)	API GL4 ISO 46/68 SAE 20W−30
Front axle : − axle housing : TD60D, TD70D models . . . . . . TD80D, TD90D, TD95D models . final drives (each) : TD60D, TD70D models . . . . . . TD80D, TD90D, TD95D models .	 4.5 7.0 0.8 1.25	 1.2 1.8 0.2 0.3		
Rear axle (bevel drive, final drives and brakes), transmission, hydraulic lift, power take−off and hydrostatic steering : TD60D, TD70D models . . . . . . TD80D, TD90D, TD95D models . − with synchro−reverser : All models	 49 55 55	 12.9 13.1 13.1		
Front wheel hubs	−		Grease **AMBRA GR9** (NH 710 A)	NLGI 2
Grease fittings	−			

SECTION 10 − ENGINE

Chapter 1 − Engine

CONTENTS

GENERAL SPECIFICATIONS	3 cylinders	4 cylinders
Engine type:		
− mod. TD60D normally aspirated − type 8035.05D.939 (BOSCH pump)	see data pages 6−7	−
− mod. TD70D turbocharged − type 8035.25C.939 (BOSCH pump)	see data pages 8−9	−
− mod. TD80D normally aspirated − type 8045.05R.939 (BOSCH pump)	−	see data pages 10−11
− mod. TD90D turbocharged − type 8045.25.939 (BOSCH pump)	−	see data pages 12−13
− mod. TD95D turbocharged − type 8045.25L.939 (BOSCH pump)	−	see data pages 14−15
Cycle	Diesel, 4−stroke	
Fuel injection	Direct	
Number of cylinders in line	3	4
Cylinder liners		dry force−fitted in cylinder block
Piston diameter		
− mod. TD60D	104 mm (4.0945 in.)	−
− mod. TD70D	104 mm (4.0945 in.)	−
− mod. TD80D	−	104 mm (4.0945 in.)
− mod. TD90D	−	104 mm (4.0945 in.)
− mod. TD95D	−	104 mm (4.0945 in.)
Piston stroke	115 mm (4.5276 in.)	
Total displacement:		
− mod. TD60D−TD70D	2931 cm^3 (178.8496 $in.^3$)	−
− mod. TD80D−TD90D−TD95D	−	3908 cm^3 (238.4662 $in.^3$)
Compression ratio	17 to 1 normally aspirated 16.5 to 1 turbocharged	
Maximum power 2000/25 EC at 2500 rpm:		
− mod. TD60D	43.4 kW (59 hp)	−
− mod. TD70D	50.7 kW (69 hp)	−
− mod. TD80D	−	58.8 kW (80 hp)
− mod. TD90D	−	65.5 kW (89 hp)
− mod. TD95D	−	69.1 kW (94 hp)
Maximum power ECE R 24 at 2500 rpm:		
− mod. TD60D	41.2 kW (56 hp)	−
− mod. TD70D	47.8 kW (65 hp)	−
− mod. TD80D	−	55.9 kW (76 hp)
− mod. TD90D	−	63.3 kW (86 hp)
− mod. TD95D	−	66.9 kW (91 hp)
Fast idling speed	2500 rpm.	
Maximum torque (daNm) at 1500 rpm: TD60D model	20.7 (152.6753 ft lb)	−
Maximum torque (daNm) at 1500 rpm: TD70D model	25.0 (184.3905 ft lb)	−
Maximum torque (daNm) at 1500 rpm: TD80D model	−	27.9 (205.9778 ft lb
Maximum torque (daNm) at 1500 rpm: TD90D model	−	32.0 (236.0194 ft lb)
Maximum torque (daNm) at 1500 rpm: TD95D model	−	33.7 (248.5584 ft lb)
Number of main bearings	4	5
Sump	Structural, cast iron	

(Continued)

(continued)

GENERAL SPECIFICATIONS	3 cylinders	4 cylinders
Lubrication	forced, with gear pump	
Pump drive	camshaft	
Engine speed/oil pump speed ratio	2:1	
Oil cleaning	mesh filter on oil intake and cartridge filter on delivery line	
Normal oil pressure, with engine hot and at fast idling speed:	2.9 to 3.9 bar (42.06 to 56.56 psi)	
Pressure relief valve	built into pump housing	
Valve opening pressure	3.5 bar (50.76 psi)	
For further lubrication data	See page 23	
Cooling system	coolant circulation	
Radiator on TD60D, TD70D, TD80D and TD90D models	three−row vertical pipes with copper fins	
Radiator on TD95D models	four−row vertical pipes with copper fins	
Fan, attached to coolant pump pulley	four−blade steel exhauster fan	
	6−blade steel exhauster fan (TD95D)	
Coolant pump	centrifugal vane−type	
Engine speed/coolant pump speed ratio	1:1,403	
Temperature control	Thermostat	
Coolant temperature gauge	coloured scale divided into three sections	
Temperature ranges corresponding to each section:		
− initial white section	from 30° to 65° C (86° to 149° F)	
− middle green section	from 65° to 105° C (149° to 221° F)	
− final red section	from 105° to 115° C (221° to 300.2° F)	
For further cooling system data	See page 23	
Rev counter	incorporated in control panel	
Rev counter drive	from gear on camshaft	
Hour counter calibrated for engine speed of	1800 rpm.	

(Continued)

(continued)

GENERAL SPECIFICATIONS	3 cylinders	4 cylinders
Timing	overhead valves operated by a camshaft located in the engine block through tappets, pushrods and rockers. Camshaft is driven by the crankshaft through helical gears.	
Intake:		
− start: before T.D.C	12°	
− end: after B.D.C	31°	
Exhaust:		
− start: before B.D.C	50°	
− end: after T.D.C	16°	
Valve clearance for timing check	0.45 mm (0.0177 in.)	
Valve clearance for normal running (engine cold):		
− intake	0.30 ± 0.05 mm (0.0118 ± 0.0020 in.)	
− exhaust	0.30 ± 0.05 mm (0.0118 ± 0.0020 in.)	
For further timing data	See page 20	
Fuel System		
Air cleaning	dual cartridge dry air filter, with clogged filter indicator with centrifugal pre−filter and automatic dust ejector.	
Fuel pump	with double diaphragm	
Fuel filter	mesh filter in fuel supply pump, and replaceable cartridge on delivery line to injection pump.	
Minimum fuel flow rate with pump shaft rotating at 1600 rev/min.	100 litres/hour	
Operated by eccentric cam	on camshaft	
BOSCH Injection pump	rotary distributor type	
All−speed governor, incorporated in pump: BOSCH	centrifugal counterweights	
Automatic advance regulator, incorporated in pump: BOSCH	hydraulic	
For further fuel system data:	see pages 5 to 15	
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 tables from page 6 to page 14.	

DATA

Turbocharger (Model TD95D):	
− . . . . . GARRETT type	T25
Fuel injection pump	distributor type with incorporated speed governor and automatic advance regulator
BOSCH pump:	
− . . . . . TD60D model	VE 3/12 F 1250 L 976 − 504054473
− . . . . . TD70D model	VE 3/12 F 1250 L 977 − 504054474
− . . . . . TD80D model	VE 4/12 F 1250 L 985 − 504041416
− . . . . . TD90D model	VE 4/12 F 1250 L 982 − 504042214
− . . . . . TD95D model	VE 4/12 F 1250 L 952 − 504042718
Direction of rotation	anticlockwise
Injection order	1−2−3 (TD60D and TD70D) 1−3−4−2 (TD80D, TD90D and TD95D)

Fuel injectors:					
BOSCH					
− Nozzle holder type					
− Nozzle type					
Number of nozzle holes	5		6		
Diameter of nozzle orifices					
Pressure setting	248−272 bar (3596.9176−3945.0064 psi)		248−272 bar (3596.9176−3945.0064 psi)		
	TD70D	TD95D	TD60D	TD80D	TD90D
Fuel delivery lines − BOSCH pump					
− Type					
− Dimensions . . . . . mm	−	−	−	−	−

TD60D MODEL − CALIBRATION DATA FOR BOSCH INJECTION PUMP TYPE VE 3/12 F 1250 L 976 − 504054473

ASSEMBLY DATA

Pump timing on engine: delivery start 4° ± 0.5° before TDC of cylinder 1 compression stroke.
Plunger pre−lift for timing on engine: 1 mm from B.D.C. (with tools **380000228 − 380001601**).
Cylinder no. 1 delivery line union on pump: marked with letter A.

ASSEMBLY DIMENSIONS

SYMBOL	K	KF	MS1	ya	yb
mm	3.6 to 3.8	3	0.85 to 1.15	36.9 to 40.9	41.5 to 46.5

CALIBRATION TEST CONDITIONS

Test bench conforming to ISO 4008/1.../2
Injectors conforming to ISO 7440−A61 − (1688901027 with pad ∅ 0.5 mm)
Injector setting pressure: 250 bar (3625.925 psi).
Fuel supply pressure: 0.35 ±0.05 bar (kg/cm^2). (5.0763 ± 0.7252 psi).
Delivery pipes (conforming to ISO 4093.2):
6 x 2 x 450 mm (0.2362 x 0.787 x 17.7165 in.).
Graduate drain time: 30 seconds
Test liquid: ISO 4113 at a temperature of 55° ± 1°C (131° ± 33.8°F).

1. START OF DELIVERY

Plunger pre−lift from BDC: mm −	Pump rotation (viewed from drive side): anticlockwise	Injection order:1−2−3

2. ADVANCE REGULATOR STROKE

rpm: 1150	Advance stroke: mm 1.6 to 2.0

3. FUEL SUPPLY PUMP PRESSURE

rpm: 1150	Internal pressure: bar 8.4 to 8.8

4. FULL LOAD DELIVERY

rpm: 800	Delivery per 1000 shots: cm^3 77.3 to 77.7	Spread: cm^3 −

5. SPREAD GOVERNOR AT IDLE SPEED

rpm: 325	Delivery per 1000 shots: cm^3 9.5 to 10.5	Spread: cm^3 ≤ 5.0

6. SPREAD GOVERNOR AT MAXIMUM SPEED

rpm: 1300	Delivery per 1000 shots: cm^3 49.5 to 50.5	Spread:−

7. DELIVERY AT STARTING SPEED

rpm: 100	Delivery per 1000 shots: cm^3 70 to 110

8. INJECTION ADVANCE PROGRESSION

Rev/min		1250	1150	1050
Advance stroke	mm	1.9 to 2.9	1.6 to 2.0	0.8 to 1.6

9. TRANSFER PRESSURE PROGRESSION

Rev/min		500	1150	−
Internal pressure	bar	4.8 to 5.8	8.4 to 8.8	−

10. BACKFLOW

Rev/min		500	1250
Backflow	cm^3/10 s	44.5 to 77.7	58.3 to 97.1

(continued)

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

(continued)

11. DELIVERY PROGRESSION

Rev/min	Delivery per 1000 shots: cm^3
1390	0 to 3
1300	49.5 to 50.5
1250	63.5 to 68.5
800	77.3 to 77.7
450	68,0

12. ZERO DELIVERY (STOP)

Rev/min	Voltage (volts)	Delivery per 1000 shots: cm^3
325	0	0 to 3

13. DELIVERY CHECK AT IDLE SPEED

Rev/min		250	325	390
Delivery per 1000 shots:	cm^3	35	9.5 to 10.5	0 to 3.0

14. AUTOMATIC START SUPPLEMENT

Rev/min	Delivery per 1000 shots: cm^3
100	70 to 110
250	67 to 77

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

BENCH TEST PERFORMANCE DATA

Test Conditions

TDC fixed advance with cylinder No. 1 in compression stroke: (see previous page).

Engine without fan, air filter and exhaust silencer.

Atmospheric pressure: 990 mbar

Relative humidity 70% ± 5.

Ambient temperature 25 °C.

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

Throttle lever position	Braking load applied	Engine rpm rpm	Power output with engine run−in for a total of:		Fuel consumption kg/h
			2 hours kW (HP)	50 hours kW	
Maximum	For maximum torque	2500	−	39,5 − 42,0	9,1 − 9,7
Maximum	For maximum torque	1500	−	31,5 − 33,5	6,8 − 7,2
Maximum	None (no−load)	2770 ± 25	−	−	−
Minimum	None (no−load)	650 ± 25	−	−	−

TD70D MODEL − CALIBRATION DATA FOR BOSCH INJECTION PUMP TYPE VE 3/12 F 1250 L 977 − 504054474

ASSEMBLY DATA

Pump timing on engine: delivery start 0° ± 0.5° before TDC of cylinder 1 compression stroke.
Plunger pre−lift for pump timing on engine: 1 mm from B.D.C. with tools **380000228 − 380001601**).
Delivery line union on pump for cylinder no. 1: marked with letter A.

ASSEMBLY DIMENSIONS

SYMBOL	K	KF	MS	ya	yb
mm	3.6 to 3.8	3	0.5 to 0.9	35.5 to 39.5	39.8 to 44.8

CALIBRATION TEST CONDITIONS

Test bench conforming to ISO 4008/1.../2
Injectors conforming to ISO 7440−A61 − (1688901027 with pad ∅ 0.5 mm (0.0197 in.))
Injector setting pressure: 250 bar (3625.925 psi).
Fuel supply pressure: 0.35 ± 0.05 bar (5.0763 ± 0.7252 psi).
Delivery pipes (conforming to ISO 4093.2): 6 x 2 x 450 mm (0.2362 x 0.787 x 17.7165 in.)
Graduate drain time: 30 seconds
Test liquid: ISO 4113 at a temperature of 55° ± 1°C (131° ± 33.8°F).

1. START OF DELIVERY

Plunger pre−lift from B.D.C.: mm −	Pump rotation (viewed from drive side): anticlockwise	Injection order:1−2−3

2. ADVANCE REGULATOR STROKE

1100 rpm	LDA pressure: kPa 100	Advance stroke: mm 1.8 to 2.2

3. FUEL SUPPLY PUMP PRESSURE

rpm: 800	LDA pressure: kPa 100	Internal pressure: bar 7.7 to 8.3

4. FULL−LOAD DELIVERY WITH BOOSTER PRESSURE

rpm: 900	LDA pressure: kPa 100	Delivery per 1000 shots: cm^3 76.5 to 76.9	Spread: $cm^3 \leq 3.5$

5. FULL−LOAD DELIVERY WITHOUT BOOSTER PRESSURE

rpm: 600	LDA pressure: kPa 0	Delivery per 1000 shots: cm^3 73.8 to 74.2	Spread: cm^3 −

6. SPREAD GOVERNOR AT IDLE SPEED

rpm: 325	LDA pressure: kPa 0	Delivery per 1000 shots: cm^3 12 to 13	Spread: $cm^3 \leq 4.5$

7. SPREAD GOVERNOR AT MAXIMUM SPEED

rpm: 1350	LDA pressure: kPa 100	Delivery per 1000 shots: cm^3 32.0 to 33.0	Spread: cm^3 −

8. DELIVERY AT STARTING SPEED

rpm: 100	Delivery per 1000 shots: cm^3 100 to 140

9. INJECTION ADVANCE PROGRESSION

LDA pressure	kPa	100		
Rev/min		1250	1100	900
Advance stroke	mm	2.5 to 3.5	1.8 to 2.2	0.3 to 1.3

10. TRANSFER PRESSURE PROGRESSION

LDA pressure	kPa	100		
Rev/min		1250	1100	500
Internal pressure supply:	bar	8,7	7.7 to 8.3	4.5 to 5.5

11. BACKFLOW

Rev/min		1250	500
LDA pressure	kPa	100	100
Backflow for	cm^3/10 s	66.7 to 105.5	50.0 to 77.6

(continued)

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

(continued)

12. DELIVERY PROGRESSION

Rev/min	LDA pressure kPa	Delivery per 1000 shots: cm^3
1390	100	0 to 3.0
1350	100	32 to 33
1250	100	66 to 71
900	100	76.5 to 76.9
600	27,5	76.2 to 77.2
400	100	91
600	0	73.8 to 74.2

13. ZERO DELIVERY (STOP)

rpm: 325	Voltage (volts): 0	Delivery per 1000 shots: cm^3: 0 to 3

14. DELIVERY CHECK AT IDLE SPEED

Rev/min	325	380	−
Delivery per 1000 shots: cm^3	12 to 13	0 to 3.0	−

15. AUTOMATIC START SUPPLEMENT

Rev/min	Delivery per 1000 shots: cm^3
100	100 to 140
300	77 to 87

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

BENCH TEST PERFORMANCE DATA	
Test Conditions	
TDC fixed advance with 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.
Atmospheric pressure: 990 mbar	Specific gravity of diesel fuel 830 ± 10 g/litre.

Throttle lever position	Braking load applied	Engine rpm 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	Fuel consumption kg/h
Maximum	For maximum torque	2500	−	47.5 − 50.5	11.1 − 11.8
Maximum	For maximum torque	1500	−	37.0 − 39.5	8.2 − 8.7
Maximum	None (no−load)	2770 ± 25	−	−	−
Minimum	None (no−load)	650 ± 25	−	−	−

TD80D MODEL − CALIBRATION DATA FOR BOSCH INJECTION PUMP TYPE VE 4/12 F 1250 L 985 − 504041416

ASSEMBLY DATA

Pump timing on engine: delivery start $4^{o} \pm 0.5^{o}$ before T.D.C. of cylinder 1 on compression stroke.
Plunger pre−lift for timing on engine: 1 mm from B.D.C. (with tools **380000228** − **380001601**).
Delivery union of the pump corresponding to cylinder no. 1: marked with letter A.

ASSEMBLY DIMENSIONS

SYMBOL	K	A	MS	ya	yb
mm	3.64 to 3.76	1.4 to 1.5	0.5 to 0.9	38,9	43,0

Test bench conforming to ISO 4008/1 .../2
Injectors conforming to ISO 7440−A61 − (1.688.901.027 with calibrated pad ∅ 0.5 mm (0.0197 in.)).
Injector pressure setting 250 to 253 bar (3625.925 to 3699.4361 psi)
Fuel supply pressure:
0.35 ±0.05 bar (5.0763 ± 0.7252 psi).
Delivery pipes (conforming to ISO 4093.2):
6 x 2 x 450 mm (0.2362 x 0.787 x 17.7165 in.).
Graduate drain time : 30”.
Test liquid: ISO 4113 at a temperature of $55^{o} \pm 1^{o}C$ ($131° \pm 33.8°F$).

CALIBRATION TEST CONDITIONS

1. START OF DELIVERY

Plunger pre−lift from BDC: mm −	Pump rotation (viewed from drive side): anticlockwise	Injection order:1−3−4−2

2. ADVANCE REGULATOR STROKE

rpm: 1250	Advance stroke: mm 2.0 to 3.2

3. FUEL SUPPLY PUMP PRESSURE

rpm: 1000	Internal pressure: bar 6.7 to 8.1

4. FULL LOAD DELIVERY

rpm: 1000	Delivery per 1000 shots: cm^3 65.2 to 70.3	Spread: $cm^3 \leq 3.5$

5. SPREAD GOVERNOR AT IDLE SPEED

rpm: 325	Delivery per 1000 shots: cm^3 4.0 to 18.0	Spread: $cm^3 \leq 4.5$

6. SPREAD GOVERNOR AT MAXIMUM SPEED

rpm: 1250	Delivery per 1000 shots: cm^3 60.0 to 66.0	Spread:−

7. DELIVERY AT STARTING SPEED

rpm: 100	Delivery per 1000 shots: cm^3 75 to 115

8. INJECTION ADVANCE PROGRESSION

Rev/min		1000	1250
Advance stroke	mm	0.5 to 1.7	2.0 to 3.2

9. TRANSFER PRESSURE PROGRESSION

Rev/min		1000	400	
Internal pressure	bar	6.7 to 8.1	4.1 to 5.5	

10. BACKFLOW

Rev/min		400	1250
Backflow	l/h	16 to 30	21 to 39

(continued)

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

(continued)

11. DELIVERY PROGRESSION

Rev/min	Delivery per 1000 shots: cm^3
1400	0 to 3
1250	60.0 to 66.0
1000	65.2 to 70.3
450	63.5 to 70.3

12. ZERO DELIVERY (STOP)

Rev/min	Voltage (volts)	Delivery per 1000 shots: cm^3
325	0	0 to 3

13. DELIVERY CHECK AT IDLE SPEED

Rev/min		325	380	−
Delivery per 1000 shots:	cm^3	4.0 to 18.0	0 to 3.0	−

14. AUTOMATIC START SUPPLEMENT

Rev/min	Delivery per 1000 shots: cm^3
100	75 to 115
250	60.5 to 74.5

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

BENCH TEST PERFORMANCE DATA	
Test Conditions	
TDC fixed advance with 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.
Atmospheric pressure: 990 mbar	Specific gravity of diesel fuel 830 ± 10 g/litre.

Throttle lever position	Braking load applied	Engine rpm	Power output with engine run−in for a total of:		Fuel consumption
			2 hours	50 hours	
		rpm.	kW (HP)	kW (HP)	kg/h
Maximum	For maximum torque	2500	−	54.0 − 57.5	12.3 − 13.1
Maximum	For maximum torque	1500	−	39.5 − 42	8.5 − 9.0
Maximum	None (no−load)	2725 ± 25	−	−	−
Minimum	None (no−load)	650 ± 25	−	−	−

TD90D MODEL − CALIBRATION DATA FOR BOSCH INJECTION PUMP TYPE VE 4/12 F 1250 L 982 − 504042214

ASSEMBLY DATA

Pump timing on engine: delivery start $1^{o} \pm 0.5^{o}$ before T.D.C. of cylinder 1 on compression stroke.
Plunger pre−lift for timing on engine: 1 mm from B.D.C. (with tools **380000228** − **380001601**).
Delivery union of the pump corresponding to cylinder no. 1: marked with letter A.

ASSEMBLY DIMENSIONS

SYMBOL	K	A	MS	ya	yb
mm	3.64 to 3.76	1.4 to 1.5	0.7 to 0.9	37.9 to 39.9	39.3 to 44.7

Test bench conforming to ISO 4008/1 .../2
Injectors conforming to ISO 7440−A61 − (1.688.901.027 with calibrated pad ∅ 0.5 mm (0.0197 in.)).
Injector pressure setting 250 to 253 bar (3625.925 to 3741.9546 psi).
Fuel supply pressure:
0.35 ±0.05 bar (5.0763 ± 0.7252 psi).
Delivery pipes (conforming to ISO 4093.2):
6 x 2 x 450 mm (0.2362 x 0.787 x 17.7165 in.).
Graduate drain time : 30”.
Test liquid: ISO 4113 at a temperature of $55^{o} \pm 1^{o}C$ ($131° \pm 33.8°F$).

CALIBRATION TEST CONDITIONS

1. START OF DELIVERY

Plunger pre−lift from BDC: mm −	Pump rotation (viewed from drive side): anticlockwise	Injection order:1−3−4−2

2. ADVANCE REGULATOR STROKE

rpm: 1250	Advance stroke: mm 2.4 to 3.6

3. FUEL SUPPLY PUMP PRESSURE

rpm: 1250	Internal pressure: bar 8.7 to 10.1

4. FULL LOAD DELIVERY

rpm: 900	Delivery per 1000 shots: cm^3 77.5 to 82.5	Spread: $cm^3 \leq 3.5$

5. SPREAD GOVERNOR AT IDLE SPEED

rpm: 375	Delivery per 1000 shots: cm^3 5.5 to 19.5	Spread: $cm^3 \leq 4.5$

6. SPREAD GOVERNOR AT MAXIMUM SPEED

rpm: 1250	Delivery per 1000 shots: cm^3 69.5 to 75.5	Spread:−

7. DELIVERY AT STARTING SPEED

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

8. INJECTION ADVANCE PROGRESSION

Rev/min		1000	1250
Advance stroke	mm	0.2 to 1.0	2.4 to 3.6

9. TRANSFER PRESSURE PROGRESSION

Rev/min		1250	400	
Internal pressure	bar	8.7 to 10.1	3.6 to 5.0	

10. BACKFLOW

Rev/min		400	1250
Backflow	l/h	15 to 29	22 to 40

(continued)

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

(continued)

11. DELIVERY PROGRESSION

Rev/min	Delivery per 1000 shots: cm^3
1400	0 to 3
1250	69.5 to 75.5
900	77.5 to 82.5
400	76.5 to 83.5

12. ZERO DELIVERY (STOP)

Rev/min	Voltage (volts)	Delivery per 1000 shots: cm^3
375	0	0 to 3

13. DELIVERY CHECK AT IDLE SPEED

Rev/min		375	425	−
Delivery per 1000 shots:	cm^3	5.5 to 19.5	0 to 3.0	−

14. AUTOMATIC START SUPPLEMENT

Rev/min	Delivery per 1000 shots: cm^3
100	80 to 120
275	68 to 92

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

BENCH TEST PERFORMANCE DATA	
Test Conditions	
TDC fixed advance with 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.
Atmospheric pressure: 990 mbar	Specific gravity of diesel fuel 830 ± 10 g/litre.

Throttle lever position	Braking load applied	Engine rpm	Power output with engine run−in for a total of:		Fuel consumption
			2 hours	50 hours	
		rpm.	kW (HP)	kW (HP)	kg/h
Maximum	For maximum torque	2500	−	60.0 − 64.0	13.7 − 14.6
Maximum	For maximum torque	1500	−	46.0 − 48.8	9.8 − 10.4
Maximum	None (no−load)	2725 ± 25	−	−	−
Minimum	None (no−load)	650 ± 25	−	−	−

TD95D MODEL − CALIBRATION DATA FOR BOSCH INJECTION PUMP TYPE VE 4/12 F 1250 L 952 − 504042718

ASSEMBLY DATA

Pump timing on engine: delivery start $0^{o} \pm 0.5^{o}$ before T.D.C. of cylinder 1 on compression stroke.
Plunger pre−lift for timing on engine: 1 mm from B.D.C. (with tools **380000228** − **380001601**).
Delivery union of the pump corresponding to cylinder no. 1: marked with letter A.

ASSEMBLY DIMENSIONS

SYMBOL	K	A	MS	ya	yb
mm	3.64 to 3.76	0.98 to 1.02	0.6 to 1.0	36.5 to 38.5	41.3 to 46.7

CALIBRATION TEST CONDITIONS

Test bench conforming to ISO 4008/1 .../2
Injectors conforming to ISO 7440−A61 − (1.688.901.027 with calibrated pad ∅ 0.5 mm) (0.0197 in.).
Injector pressure setting 250 to 253 bar (3625.925 to 3741.9546 psi).
Fuel supply pressure:
0.35 ±0.05 bar (5.0763 ± 0.7252 psi).
Delivery pipes (conforming to ISO 4093.2):
6 x 2 x 450 mm (0.2362 x 0.787 x 17.7165 in.).
Graduate drain time : 30”.
Test liquid: ISO 4113 at a temperature of $55^{o} \pm 1^{o}C$ ($131° \pm 33.8°F$).

1. START OF DELIVERY

Plunger pre−lift from B.D.C.: mm −	Pump rotation (viewed from drive side): anticlockwise	Injection order:1−3−4−2

2. ADVANCE REGULATOR STROKE

rpm: 1250	LDA pressure: kPa 100	Advance stroke: mm 2.2 to 3.4

3. FUEL SUPPLY PUMP PRESSURE

1100 rpm	LDA pressure: kPa 100	Internal pressure: bar 6.5 to 7.9

4. FULL−LOAD DELIVERY WITH BOOSTER PRESSURE

rpm: 900	LDA pressure: kPa 100	Delivery per 1000 shots: cm^3 75.5 to 80.5	Spread: $cm^3 \leq 3.5$

5. FULL−LOAD DELIVERY WITHOUT BOOSTER PRESSURE

rpm: 500	LDA pressure: kPa 0	Delivery per 1000 shots: cm^3 66.0 to 72.0	Spread: cm^3 −

6. SPREAD GOVERNOR AT IDLE SPEED

rpm: 350	LDA pressure: kPa 0	Delivery per 1000 shots: cm^3 8 to 23	Spread: $cm^3 \leq 5.5$

7. SPREAD GOVERNOR AT MAXIMUM SPEED

rpm: 1250	LDA pressure: kPa 100	Delivery per 1000 shots: cm^3 66.0 to 72.0	Spread: cm^3 −

8. DELIVERY AT STARTING SPEED

rpm: 100	Delivery per 1000 shots: cm^3 75 to 115

9. INJECTION ADVANCE PROGRESSION

LDA pressure	kPa	100		
Rev/min		1100	1250	
Advance stroke	mm	1.4 to 2.6	2.2 to 3.4	

10. TRANSFER PRESSURE PROGRESSION

LDA pressure	kPa	100		
Rev/min		500	1100	−
Internal pressure supply:	bar	4.1 to 5.5	6.5 to 7.9	−

11. BACKFLOW

Rev/min		500	1250
LDA pressure	kPa	100	100
Backflow for 10 sec.	l/h	18 to 32	21 to 39

(continued)

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

(continued)

12. DELIVERY PROGRESSION

Rev/min	LDA pressure kPa	Delivery per 1000 shots: cm^3
1405	100	0 to 3.0
1250	100	66 to 72
900	100	75.5 to 80.5
600	25	72 to 78
500	0	66 to 72

13. ZERO DELIVERY (STOP)

rpm: 300	Voltage (volts): 0	Delivery per 1000 shots: cm^3: 0 to 3

14. DELIVERY CHECK AT IDLE SPEED

Rev/min	350	410	
Delivery per 1000 shots: cm^3	8 to 23	0 to 3.0	

15. AUTOMATIC START SUPPLEMENT

Rev/min	Delivery per 1000 shots: cm^3
100	75 to 115
250	63.5 to 77.5

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

BENCH TEST PERFORMANCE DATA	
Test Conditions	
TDC fixed advance with 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.
Atmospheric pressure: 990 mbar	Specific gravity of diesel fuel 830 ± 10 g/litre.

Throttle lever position	Braking load applied	Engine rpm rpm.	Power output with engine run−in for a total of: 2 hours kW	Power output with engine run−in for a total of: 50 hours kW	Fuel consumption kg/h
Maximum	For maximum torque	2500	−	66 − 70	15.5 − 15.9
Maximum	For maximum torque	1500	−	51 − 54	11 − 11.7
Maximum	None (no−load)	2700 ± 25	−	−	−
Minimum	None (no−load)	650 ± 25	−	−	−

FUEL SUPPLY PUMP DATA	mm (in.)
Eccentricity of drive shaft	3 (0.1181)
Diameter of drive shaft at bushings	31.975 to 32.000 (1.1049 to 1.1050)
Internal diameter of installed and reamed bushings	32.050 to 32.075 (1.2589 to 1.2628)
Interference between bushings and seats	0.063 to 0.140 (0.0025 to 0.0055)
Assembly clearance between shaft and bushings	0.050 to 0.100 (0.0020 to 0.0039)
Thickness of internal washer	1.45 to 1.50 (0.0571 to 0.0591)
Thickness of external washer	2.93 to 3.00 (0.1154 to 0.1181)

CRANKCASE/CYLINDER BLOCK DATA	mm (in.)
Cylinder block (4−cylinder engines)	cast−iron monobloc with replaceable dry−fitted cylinder liners, incorporating seatings for crankshaft bearings, camshaft and pushrod/tappet assemblies
Internal diameter of cylinder liners (4−cylinder engines)	104.000 to 104.024 (4.0945 to 4.0954) (1)
External diameter of cylinder liners (4−cylinder engines)	107,020 to 107.050 (4.2134 to 4.2146)
Diameter of cylinder bores (4−cylinder engines)	106.850 to 106.900 (4.2067 to 4.2087)
Interference fit between cylinder liners and bores (4−cylinder engines)	0.120 to 0.200 (0.0047 to 0.0079)
Liner internal diameter oversizes (4−cylinder engines)	0.4 to 0.8 (0.0157 to 0.0315)
Liner external diameter oversizes (4−cylinder engines)	0.2 (0.0079)
Maximum permissible liner ovality or taper due to wear (2) (4−cylinder engines)	0.12 (0.0047)
Diameter of main shell bearing seats	84.200 to 84.230 (3.3150 to 3.3161)
Diameter of camshaft bearing seats:	
− front	54.780 to 54.805 (2.1567 to 2.1577)
− middle	54.280 to 54.305 (2.1370 to 2.1380)
− rear	53.780 to 53.805 (2.1173 to 2.1183)
Diameter of standard tappet bores in crankcase	15.000 to 15.018 (0.5906 to 0.5913)
Spare tappet oversizes	0.1−0.2−0.3 (0.0039−0.0079−0.0118)

(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 (in.)
Crankshaft	balanced with integral counterweights
Standard journal diameter	79.791 to 79.810 (3.1414 to 3.1421) (1)
Journal undersizes	0.254 − 0.508 − 0.762 − 1.016 (0.01 − 0.02 − 0.03 − 0.04)
Standard main bearing shell thickness	2.168 to 2.178 (0.0854 to 0.0857)
Main bearing shell undersizes (internal diameter)	0.254 − 0.508 − 0.762 − 1.016 (0.01 − 0.02 − 0.03 − 0.04)
Bearing shell to journal clearance	0.034 to 0.103 (0.0013 to 0.0041)
Maximum permitted wear clearance	0.180 (0.0071)
Standard crankpin diameter	63.725 to 63.744 (2.5089 to 2.5096) (1)
Crankpin undersizes	0.254 − 0.508 − 0.762 − 1.016 (0.01 − 0.02 − 0.03 − 0.04)
Standard big−end bearing shell thickness	1.805 to 1.815 (0.0711 to 0.0715)
Big−end bearing shell undersizes (internal diameter)	0.254 − 0.508 − 0.762 − 1.016 (0.01 − 0.02 − 0.03 − 0.04)
Big−end bearing shell to crankpin clearance	0.033 to 0.087 (0.0013 to 0.0034)
Maximum permitted wear clearance	0.180 (0.0071)
Standard crankshaft thrust washer thickness	3.378 to 3.429 (0.133 to 0.135)
Thrust washer oversizes (thickness)	0.127 − 0.254 − 0.381 − 0.508 (0.005 − 0.010 − 0.015 − 0.020)
Width of main bearing including thrust washers	31.766 to 31.918 (1.2506 to 1.2566)
Width of corresponding crankshaft journal	32.000 to 32.100 (1.2598 to 1.2638)
Crankshaft assembly endfloat	0.082 to 0.334 (0.0032 to 0.0131)
Maximum permitted wear endfloat	0.40 (0.0157)
Maximum ovality or taper of journals and crankpin after regrinding	0.01 (0.0004)
Maximum ovality or taper of journals and crankpin	0.05 (0.002)
Maximum tolerance for alignment of crankshaft journals with crankshaft supported on the two outer journals	0.10 (0.0039)
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 (0.0098)
Maximum tolerance for run−out between the outer surfaces of the crankshaft journals and the crankshaft centreline	± 0.10 (0.004)

(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.

(continued)

BENCH TEST PERFORMANCE DATA	mm (in.)
Maximum permitted tolerance on run−out of flywheel mounting flange surface relative to the crankshaft centreline, measured with 1/100 mm (0.0394/3.94 in.) scale dial gauge resting on front flange surface at a diameter of 108 mm (4.252 in.) (total gauge reading).	0.025 (0.001)
Maximum permitted tolerance on co−axial alignment of flywheel centering seat relative to the crankshaft journals (total gauge reading)	0.04 (0.0016)

CONNECTING ROD DATA	mm (in.)
Connecting Rods	cast−iron with oil way
Diameter of small end bushing seat	41.846 to 41.884 (1.6475 to 1.6490)
Outside diameter of small end bushing	41.979 to 42.017 (1.6527 to 1.6542)
Interference between small end bushing and seat	0.095 to 0.171 (0.0037 to 0.0067)
Inside diameter of small end bushing (measured after fitting)	38.004 to 38.014 (1.4962 to 1.4966)
Diameter of big end shell bearing seats	67.407 to 67.422 (2.6538 to 2.6544)
Maximum tolerance for parallelism between the small end and big end axes measured at 25 mm (0.9843 in.)	± 0.07 (0.0028)
Maximum weight difference between con rods in same engine	25 grams (0.0551 lb)

PISTON DATA	mm (in.)	
	TD60D, TD80D	TD70D, TD90D, TD95D
Pistons	Light alloy with two compression and one oil control rings	
Standard piston diameter, measured at 57 mm (2.2441 in.) from base and perpendicularly to the gudgeon pin axis	103.852 to 103.870 (4.0886 to 4.0893)	
Piston clearance in cylinder liner	0.130 to 0.172 (0.0051 to 0.0067)	
Maximum permitted wear clearance	0.30 (0.0118)	
Piston oversizes	0.6 (0.0236)	
Piston protrusion at TDC from cylinder block face	0.355 to 0.761 (0.014 to 0.030)	
Gudgeon Pin Diameter	37.983 to 37.990 (1.4954 to 1.4957)	
Diameter of gudgeon pin seat in piston	37.994 to 38.000 (1.4958 to 1.4960)	
Gudgeon pin to seat clearance	0.004 to 0.017 (0.0001 to 0.0007)	
Gudgeon pin to small end bearing clearance	0.014 to 0.031 (0.0006 to 0.0012)	
Maximum permitted wear clearance	0.06 (0.0024)	
Maximum weight difference between pistons in same engine	20 grams (0.00441 lb)	
Piston ring groove clearance (measured vertically):		
− Top	0.090 to 0.122 (0.0035 to 0.0048)	0.105 to 0.155 (0.0041 to 0.0061)
− Second	0.060 to 0.092 (0.0024 to 0.0036)	
− Bottom	0.040 to 0.075 (0.0016 to 0.0030)	
Maximum permissible clearance (wear limit):		
− Top	0.50 (0.0197)	
− Second and bottom	0.20 (0.0079)	
Piston ring end gap (fitted):		
− Top	0.40 to 0.65 (0.0157 to 0.0256)	0.40 to 0.65 (0.0157 to 0.0256)
− Second	0.30 to 0.55 (0.0118 to 0.0217)	0.30 to 0.55 (0.0118 to 0.0217)
− Bottom	0.30 to 0.55 (0.0118 to 0.0217)	
Maximum permissible gap (wear limit)	1.20 (0.0472)	

VALVE TIMING GEAR DATA	mm (in.)
Timing gear tooth backlash	0.160 (0.0063)
Inside diameter of intermediate gear bushings (fitted and reamed)	37.050 to 37.075 (1.4578 to 1.4596)
Diameter of intermediate gear journal	36.975 to 37.000 (1.4557 to 1.4567)
Journal to bushing clearance	0.050 to 0.100 (0.0020 to 0.0039)
Maximum permissible clearance (wear limit)	0.15 (0.0059)
Bushing interference fit in seat in intermediate gear	0.063 to 0.140 (0.0025 to 0.0055)
Outside diameter of camshaft bearings:	
− front	54.875 to 54.930 (2.1604 to 2.1626)
− middle	54.375 to 54.430 (2.1407 to 2.1429)
− rear	53.875 to 53.930 (2.1175 to 2.1232)
Interference between bearings and seats in cylinder block	0.070 to 0.150 (0.0028 to 0.0059)
Inside diameter of camshaft bearings (fitted and reamed):	
− front	51.080 to 51.130 (2.0110 to 2.0130)
− middle	50.580 to 50.630 (1.9913 to 1.9933)
− rear	50.080 to 50.130 (1.9716 to 1.9736)
Diameter of camshaft journals:	
− front	50.970 to 51.000 (2.0067 to 2.0079)
− middle	50.470 to 50.500 (1.9870 to 1.9882)
− rear	49.970 to 50.000 (1.9913 to 1.9933)
Clearance between camshaft journals and bearings	0.080 to 0.160 (0.0031 to 0.0063)
Maximum permissible clearance (wear limit)	0.20 (0.0079)
Camshaft endfloat between thrust plate and seat on camshaft	0.070 to 0.220 (0.0028 to 0.0087)
For further valve timing gear data	See page 4

TAPPET DATA	mm (in.)
Tappet bore in crankcase	15.000 to 15.018 (0.5906 to 0.5913)
Outside diameter of standard tappet	14.950 to 14.970 (0.5886 to 0.5894)
Tappet running clearance	0.030 to 0.068 (0.0012 to 0.0027)
Maximum permissible clearance (wear limit)	0.15 (0.0059)
Spare tappet oversizes	0.1 − 0.2 − 0.3 (0.0039−0.0079−0.0118)

ROCKER ARM − VALVE DATA	mm (in.)
Diameter of shaft bores in rocker arms	18.016 to 18.034 (0.7093 to 0.71)
Rocker−arm shaft diameter	17.982 to 18.000 (0.708 to 0.7087)
Rocker shaft to rocker arm bore clearance	0.016 to 0.052 (0.0006 to 0.0020)
Maximum permissible clearance (wear limit)	0.15 (0.0059)
Rocker arm spacing springs:	
− free spring length	59.5 (2.3425)
− length under load of 46 to 52 N (10.4 to 11.7 lb)	44 (1.7323)
Valve clearance for timing check	0.45 (0.0177)
Cam lift:	
− inlet valve	5.97 (0.2350)
− exhaust valve	6.25 (0.2460)

BALANCER DATA (FIG. 108, page 67) (*)	(*) installed on 4−cylinder engines only
	mm (in.)
Interference fit between bushings (28) and seat in gear (26)	0.063 to 0.140 (0.0025 to 0.0055)
Clearance between intermediate gear journal (27) and bushings (28)	0.050 to 0.100 (0.002 to 0.004)
Interference fit between bushings and carrier (20)	0.063 to 0.140 (0.0025 to 0.0055)
Clearance between gear shaft (22) and bushings	0.050 to 0.100 (0.002 to 0.004)
Tooth backlash between splined sleeve (17) connecting drive gear (22) and counterweight drive gear (13)	0.038 to 0.106 (0.0015 to 0.0041)
Interference fit between front bushing (16) and bore in housing (12)	0.063 to 0.140 (0.0025 to 0.0055)
Clearance between counterweight drive shaft (13) and front bushing (16)	0.050 to 0.100 (0.002 to 0.004)
Interference fit between rear bushing of counterweight drive gear (13) and seat in carrier (6)	0.037 to 0.101 (0.0015 to 0.004)
Clearance between counterweight drive shaft (13) and rear bushing	0.013 to 0.061 (0.0005 to 0.0024)
Interference fit between bushing and seat in counterweight (8)	0.040 to 0.100 (0.0016 to 0.004)
Clearance between counterweight rotation shaft (4) and bushing	0.020 to 0.073 (0.0008 to 0.0055)
Interference fit between intermediate gear bushing (9) and related seat in housing (12)	0.037 to 0.101 (0.0025 to 0.0029)
Clearance between intermediate gear shaft (9) and related bushing	0.013 to 0.061 (0.0005 to 0.0024)
Tooth backlash between meshed gears	0.080 (0.0031)

CYLINDER HEAD DATA	mm (in.)
Cylinder Head	with valve seats cut directly in the casting and press−fitted steel valve guides.
Original height of cylinder head	92 (3.622)
Maximum surface regrinding depth	0.5 (0.0197)
Diameter of standard valve guide bores in head	13.950 to 13.983 (0.5492 to 0.5505)
Outside diameter of standard valve guides	13.993 to 14.016 (0.5509 to 0.5518)
Guide interference fit in bores	0.010 to 0.066 (0.0004 to 0.0026)
Inside diameter of valve guide (fitted in head)	8.023 to 8.043 (0.3159 to 0.3167)
Valve stem diameter	7. 985 to 8.000 (0.3144 to 0.3150)
Assembly clearance between valve stem and guide	0.023 to 0.058 (0.0009 to 0.0023)
Maximum permissible clearance (wear limit)	0.13 (0.0051)
Maximum run−out of valve guide on its stem measured through 360° with dial gauge contact point resting on valve head contact band	0.03 (0.0012)
Valve guide oversizes	0.2 (0.0079)
Valve seat angle in head:	
− inlet valve	60° ± 5’
− exhaust valve	45° ± 5’
Valve face angle:	
− inlet valve	60° 30’ ± 7’
− exhaust valve	45° 30’ ± 7’
Valve head diameter:	
− inlet valve	45.300 to 45.500 (1.7835 to 1.7913)
− exhaust valve	37.500 to 37.750 (1.4764 to 1.4862)
Valve stand−in relative to cylinder head face	0.7 to 1.0 (0.0276 to 0.0394)
Maximum permissible valve stand−in	1.3 (0.0512)
Inlet and exhaust valve springs:	
− free spring length	4.6 (1.7559)
− length with valve closed, under load of 256 to 284 N (57.54 to 63.71 lb)	34 (1.3386)
− length with valve open, under load of 502 to 544 N (112.87 to 124.78 lb)	23.8 (0.9370)
Injector protrusion relative to head face:	
● BOSCH injector	0.3 to 1.1 (0.0118 to 0.0433)