

## JCB 444 Mechanical Engine

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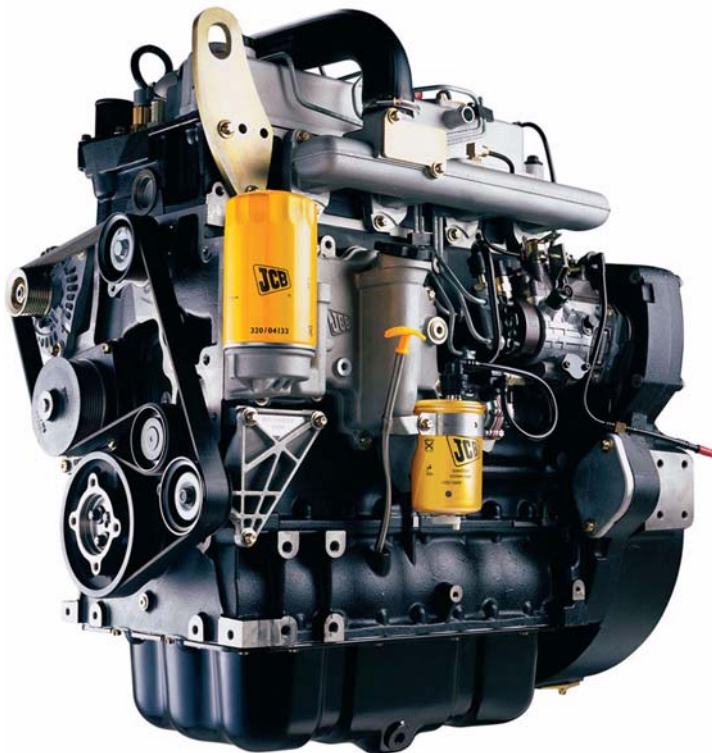
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Publication No.  
**9806/3000-04**



World Class  
Customer Support



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**Notes:**

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## General Information

Service Manual - JCB 444 Mechanical Engine

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# Introduction

## About this Manual

### Using the Service Manual

This publication is designed for the benefit of JCB Distributor Service Engineers who are receiving, or have received, training by JCB Technical Training Department.

These personnel should have a sound knowledge of workshop practice, safety procedures, and general techniques associated with the maintenance and repair of engines.

Renewal of oil seals, gaskets, etc., and any component showing obvious signs of wear or damage is expected as a matter of course. It is expected that components will be cleaned and lubricated where appropriate, and that any opened hose or pipe connections will be blanked to prevent excessive loss of hydraulic fluid, engine oil and ingress of dirt. Finally, please remember above all else **SAFETY MUST COME FIRST!**

The manufacturer's policy is one of continuous improvement. The right to change the specification of the engine without notice is reserved. No responsibility will be accepted for discrepancies which may occur between the specifications of the engine and the descriptions contained in this publication.

### Section Numbering

The manual is compiled in sections, the first three are numbered and contain information as follows:

- 1 **General Information** includes torque settings and service tools.
- 2 **Care & Safety** includes warnings and cautions pertinent to aspects of workshop procedures etc.
- 3 **Routine Maintenance** includes service schedules and recommended lubricants.

The remaining sections deal with Descriptions, Fault Finding, Dismantling, Overhaul etc. of specific components, for example:

- 4 **Systems Descriptions**

- 5 **Fault Finding ...etc.**

### Left Side, Right Side

References to the 'left' side and the 'right' side of the engine are when viewed from the flywheel end of the engine, as shown at **1A**.

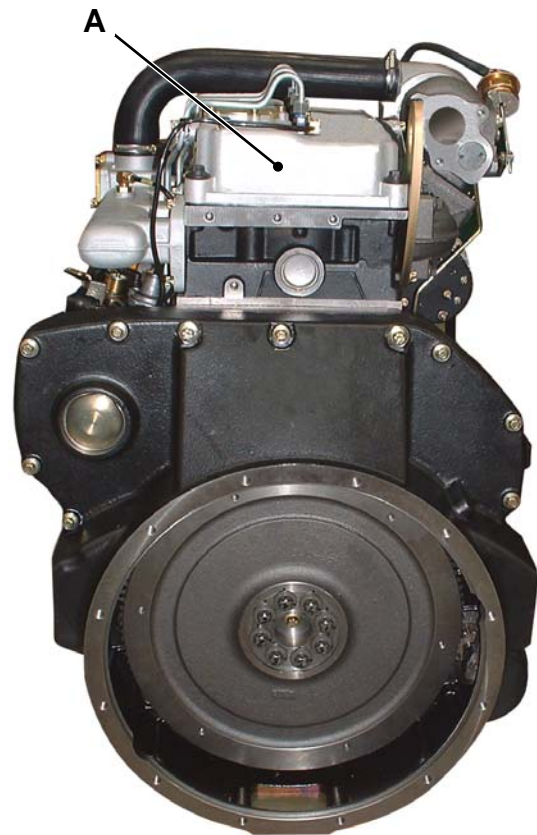


Fig 1.

### Units of Measurement

In this manual, the S.I. system of units is used. For example, liquid capacities are given in litres. The imperial units follow in parenthesis () e.g. 28 litres (6 UK gal).



### Machine Related Data

The JCB 444 Engine can be fitted to a variety of constructions and agricultural machines. The scope of this publication is limited to the engine, but references to a typical machine installation will be made. Tasks and information specific to a machine installation will be listed in the relevant machine Service Manual, for example engine removal and replacement procedures.





### Acronyms and Abbreviations

Some of the following acronyms and abbreviations are used in this service manual. The remainder are used in the automotive industry and are repeated for reference only.

°C	Celsius	Nm	Newton Metre
°F	Fahrenheit	NSP	Non Serviced Part
A/R	As Required	O/D	Outside Diameter
API	American Petroleum Institute	OEM	Original Equipment Manufacturer
BBDC	Before Bottom Dead Centre	PPM	Parts per Million
BDC	Bottom Dead Centre	PSI	Pounds per square Inch
BSFC	Brake Specific Fuel Consumption	PTO	Power Take Off
BTDC	Before Top Dead Centre	RH	Right Hand
CCV	Crankcase Vent	RME	Rapeseed Methyl Ester
CID	Cubic inch Displacement	RPM	Revolutions per Minute
CSA	Cold Start Advance	SAE	Society of Automotive Engineers
CSAS	Cold Start Advance Solenoid	SME	Sunflower Methyl Ester
cST	Centistokes	SOME	Soyabean Methyl Ester
ECM	Electronic Control Module	STD	Standard
ECS	Emission Control System	TBA	To be Advised
EPA	Environmental Protection Agency	TC	Turbocharged
ESOS	Electric Shut-Off Solenoid or Engine Shut-Off Solenoid	TCA	Turbocharged Aftercooled
FAME	Fatty Acid Methyl Esters	TDC	Top Dead Centre
FEAD	Front End Accessory Drive	TI	Technical Information
FIE	Fuel Injection Equipment	VOME	Vegetable Oil Methyl Esters
FIP	Fuel Injection Pump		
Hg	Mercury		
HP	Horse Power		
I/D	Inside Diameter		
kg	Kilogram		
KPH	Kilometres per hour		
Kw	Kilowatt		
LH	Left Hand		
ltr	Litre		
mm	Millimetre		
MPH	Miles per Hour		
NA	Naturally Aspirated		
N/A	Not Applicable/Not Available		

# Identifying the Engine

## Engine Identification Plate

### Engine Labels

Each JCB 444 Engine has a unique identification number stamped onto the main engine block, as shown at **2A**. Refer to [⇒ Engine Identification Number Explanation \( 1-5\)](#) for a full detailed description of the number.

In addition to the identification number, there is an emissions legislation label **2B**.

### Component Labels

In addition to the engine labels, some of the machine engine components will also have a label attached, or a part number etched into the casting, these include:

- the starter motor
- the alternator
- the fuel injection pump
- engine bedplate
- engine block
- cylinder head
- Turbo charger

In some instances, it may be necessary to quote the information on these labels, for instance if there is a parts query, or a warranty claim. Make a note of these numbers.

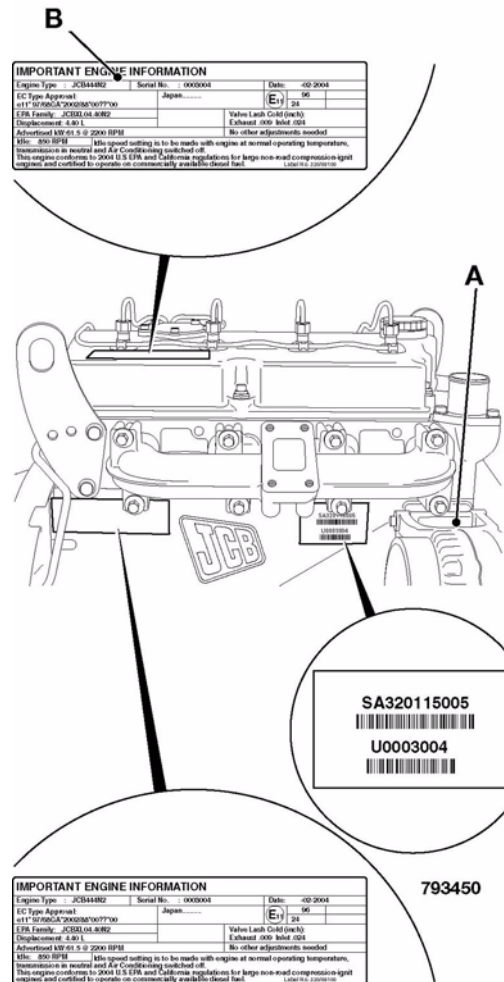


Fig 2.

### Engine Identification Number Explanation

The full engine number is stamped on the emissions label and the serial number is stamped on the engine block.  
 ⇒ [Fig 2.](#) (□ 1-4).

An explanation of the full engine number is detailed below.  
 ⇒ [Fig 4.](#) (□ 1-5).

If you need parts or service information for your engine, you must quote the complete engine number.

SA320/40000U0000104

IMPORTANT ENGINE INFORMATION		POWER SYSTEMS LTD	
Engine Type : JCB444N2	Serial No. : SA320/40000U0000104	Date: -02-2004	
EC Type Approval : e11*97/68GA*2002/88*0455*01		 96 G 010455-1 24 03/031693	
EPA Family: 6JCBL04.40NA	Advertised kW : 63.0 @ 2200 RPM		
Displacement: 4.40 L	Valve Lash Cold (mm) : Exhaust 0.60 Inlet 0.23		
Idle: 850 RPM	Idle speed setting is to be made with engine at normal operating temperature, transmission in neutral and Air Conditioning switched off.		
This engine conforms to 2005 U.S. EPA and California regulations for large non-road compression-ignition engines and certified to operate on commercially available diesel fuel.			
			320/09131

793460

Fig 3.

SA 320/40001 U 00001 04

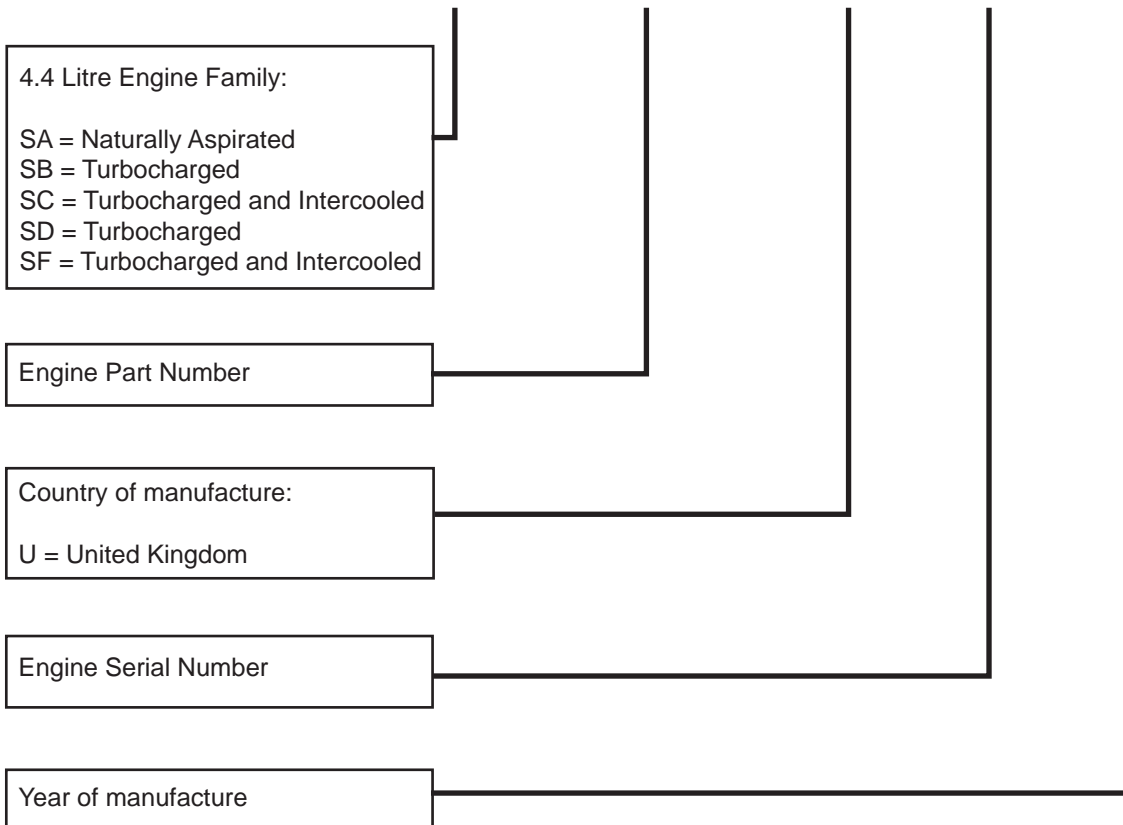


Fig 4.

### Engine Component Identification

**Table 1. Engine - As viewed on the left hand side.**

⇒ [Fig 5. \(□ 1-7\)](#)

1	Rocker cover	12	Fuel filter
2	Fuel injectors and high pressure fuel pipes	13	Lubrication oil filler cap
3	Lubrication oil filler cap	14	Lubrication oil filter
4	Timing gear case	15	Lubrication oil cooler housing
5	Flywheel housing	16	Lubrication oil dip stick
6	Bed plate	17	Low duty PTO (blanking cover if no device is fitted)
7	Lubrication oil pan (sump)	18	Water temperature sender (cold start)
8	Engine lifting eye	19	Low pressure fuel line (to tank)
9	Air Inlet manifold	20	Oil drain plug (sump)
10	Fuel injection pump	21	Oil pressure switch
11	Fuel lift pump	22	Inlet manifold induction heater (if fitted)

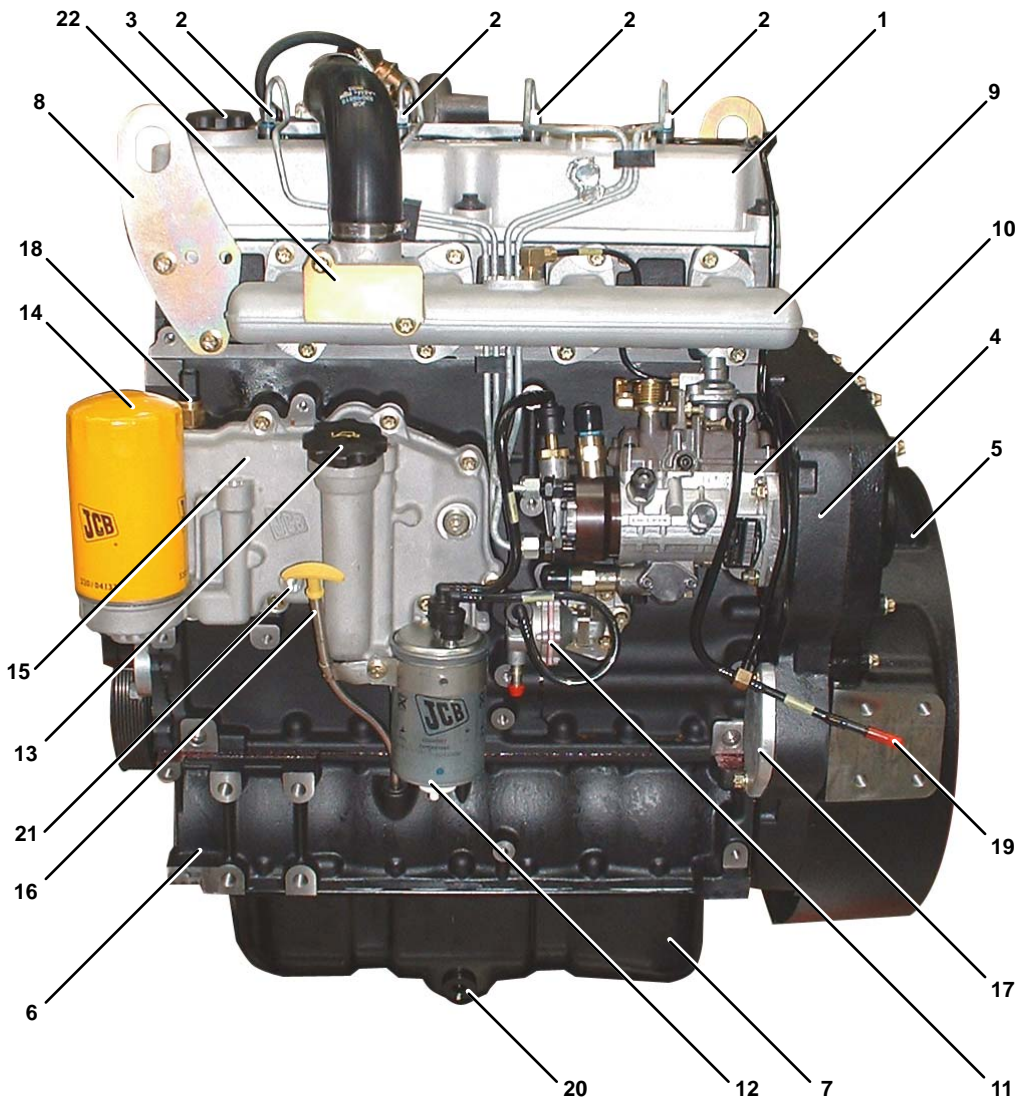


Fig 5. SB Type engine shown

**Table 2. Engine - As viewed on the right hand side**

⇒ [Fig 6. \(□ 1-9\)](#)

1	Rocker cover	11	Exhaust manifold
2	Breather chamber inspection cover	12	Alternator and drive pulley assembly (belt not fitted)
3	Cylinder block	13	Coolant pump drive pulley (belt not fitted)
4	Timing gear case	14	Coolant pump housing (cylinder block)
5	Flywheel housing	15	Coolant inlet/radiator hose connector
6	Bed plate	16	Heavy duty PTO (blanking cover if no device is fitted)
7	Lubrication oil pan (sump)	17	Starter motor assembly
8	Lifting eye	18	Turbocharger oil drain line (turbocharged engine only)
9	Turbocharger (turbocharged engine only)	19	Turbocharger oil feed line (turbocharged engine only)
10	Turbocharger waste gate actuator assembly	20	Oil drain plug (sump)

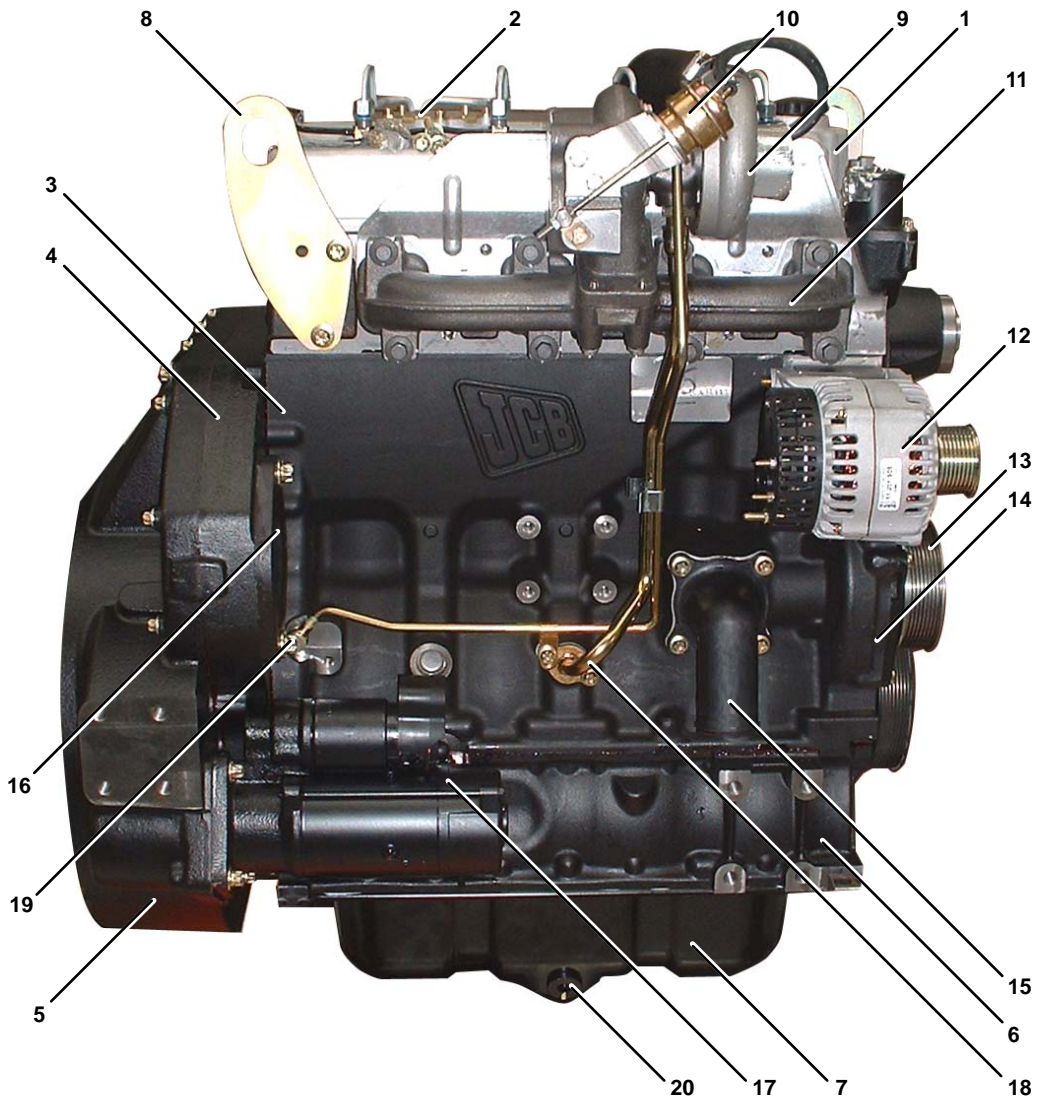
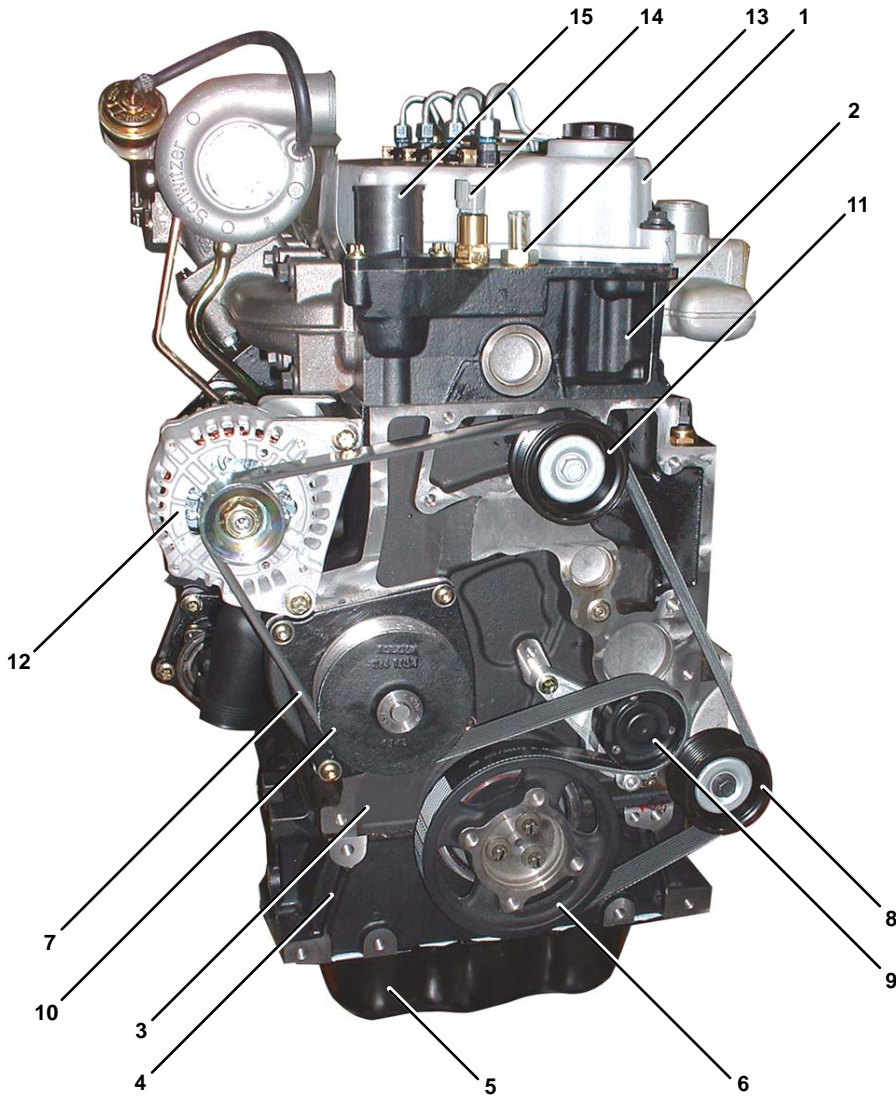


Fig 6. SB Type engine shown



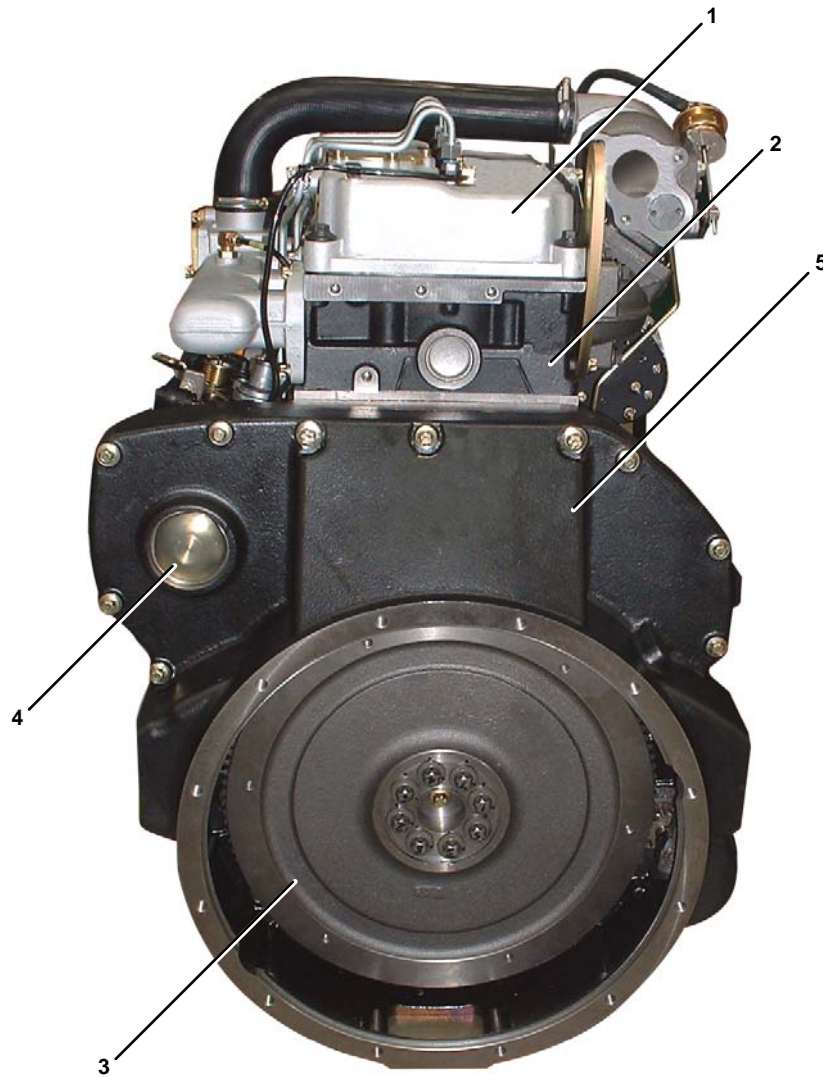
**Fig 7. SB Type engine shown**

**Table 3. Engine - As viewed on the crankshaft pulley (front) end**

⇒ Fig 7. (□ 1-10)

1	Rocker cover	9	Drive belt tensioner and pulley
2	Cylinder head	10	Coolant pump and drive pulley assembly
3	Cylinder block	11	Idler pulley
4	Bed plate	12	Alternator and drive pulley assembly
5	Lubrication oil pan (sump)	13	Cab heater water hose connector
6	Crankshaft pulley	14	Coolant temperature sender
7	Front end accessory drive belt	15	Coolant thermostat housing/radiator hose connector
8	Idler pulley		





**Fig 8. SB Type engine shown**

**Table 4. Engine - As viewed on the flywheel (rear) end**

⇒ [Fig 8. \(□ 1-11\)](#)

1	Rocker cover	4	Fuel injection pump drive gear cover
2	Cylinder head	5	Flywheel housing
3	Flywheel		

# Technical Data

## Basic Engine Data

### Engine Specifications

Engine Type:	
- SA	Naturally Aspirated
- SB	Turbocharged
- SC	Turbocharged with Intercooler
- SD	Turbocharged
- SF	Turbocharged with Intercooler
Rated speed	2200 rpm
Weight (Dry):	
- SA	472 kg (1040 lb)
- SB, SC, SD, SF	477 kg (1052 lb)
Number of cylinders	4
Nominal bore size	103 mm (4.055 in)
Stroke	132 mm (5.16 in)
Cylinder arrangement	In line
Combustion Cycle	4-stroke
Firing order	1-3-4-2
Displacement	4.40 litres
Compression ratio	
- SA	18.6 : 1
- SB	18.3 : 1
- SC	17.5 : 1
- SD, SF	17.2 : 1
Engine Compression	see Note <sup>(1)</sup>
Direction of rotation (viewed from front {crankshaft pulley} end)	Clockwise
Valves	4 per cylinder
Valve tip clearances (measured cold):	
- SA, SB, SC	Inlet: 0.19 to 0.27 mm (0.007 to 0.011 in)
	Exhaust: 0.56 to 0.64 mm (0.022 to 0.025 in)
- SD, SF	Inlet: 0.35 mm (0.014 in)
	Exhaust: 0.56 to 0.64 mm (0.022 to 0.025 in)
Lubricating oil pressure <sup>(2)</sup>	4.0 to 4.8 bar (58 to 70 lb in <sup>2</sup> )
Combustion system	Direct Injection



## Section 1 - General Information Technical Data

Basic Engine Data

Fuel injection pump	Rotary Mechanical
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- (1) *Compression variance between each cylinder should be no greater than 3.5 bar (50 lb in<sup>2</sup>)*
- (2) *Engine at normal operating temperature and maximum revs.*



## Engine Block & Bedplate Data

Cylinder bore <sup>(1)</sup>	103.000 to 103.020 mm (4.055 to 4.046 in)
Main bearing bolts torque <sup>(2)</sup>	
- first stage	50 Nm (37 lbf ft)
- second stage	115 Nm ( 85 lbf ft)
- final stage	turn a further 180°
Surface finish for cylinder head joint	Rz < 15um; Rmax < 20um
Diameter of first oversize bore	103.500 to 103.520 mm (4.074 to 4.076 in)
Diameter of second oversize bore	104.00 to 104.020 mm (4.094 to 4.952 in)
Main bearing bore (without bearings)	
- numbers 1 to 4	92.000 to 92.020 mm (3.622 to 3.623 in)
- number 5	105.000 to 105.020 mm (4.134 to 4.135 in)
Main bearing bore (with bearings)	
- numbers 1 to 4	88.047 to 88.090 mm (3.466 to 3.468 in)
- number 5	100.047 to 100.090 mm (3.939 to 3.941 in)
Camshaft bore	
- numbers 1 to 4	60.040 to 60.070 mm (2.364 to 2.365 in)
- number 5 (bush) <sup>(3)</sup>	60.290 to 60.32 mm (2.374 to 2.375 in)
Permissible wave profile	wt<10m (2.5 distance)

(1) Nominal diameter to be measured 63mm below head face.

(2) Torque information **MUST** be used in conjunction with recommended procedures contained in this manual. Failure to use the appropriate and correct removal, replacement, dismantle and assembly procedures may result in an engine failure in service. Refer also to the procedures for the correct bolt tightening sequence.

(3) Bush no longer fitted from January 2008.

## Cylinder Head Data

Cylinder head distortion (maximum permissible)	
- end to end	0.05 mm (0.002 in)
- side to side	0.03 mm (0.0012 in)
Valve recess depth	
- Inlet	0.85 mm (0.033 in)
- Exhaust	0.85 mm (0.033 in)
Valve seat angle	
- inlet	120 ° (inclusive)
- exhaust	90 ° (inclusive)
Cylinder head bolts torque <sup>(1)</sup>	
- first stage	40 Nm (30 lbf ft)
- second stage	75 Nm (56 lbf ft)
- third stage	repeat 75 Nm
- fourth stage	torque angle + 90 °
- final stage	torque angle + 180°
Surface finish for cylinder head joint	Rz < 15um; Rmax < 20um
Permissible wave profile	wt < 10um 2.5 distance

(1) *Torque information MUST be used in conjunction with recommended procedures contained in this manual. Failure to use the appropriate and correct removal, replacement, dismantle and assembly procedures may result in an engine failure in service. Refer also to the procedures for the correct bolt tightening sequence.*

### Inlet and Exhaust Valve Data

Max lift inlet	
- SA, SB, SC	9.37 mm @ 101° atdc
- SD, SF	9.64 mm @ 101° atdc
Max lift exhaust	
- SA	9.42 mm @ 110° btdc
- SB, SC	9.42 mm @ 115° btdc
- SD, SF	9.84 mm @ 115° btdc
Inlet opens (top of ramp)	
- SA, SB, SC	10° btdc
- SD, SF	6° btdc
Inlet closes	
- SA, SB, SC	32° abdc
- SD, SF	28° abdc
Exhaust opens	
- SA	50° bbdc
- SB, SC	60° bbdc
- SD, SF	41° bbdc
Exhaust closes	
- SA, SB, SC	10° atdc
- SD, SF	9° atdc
Valve stem diameter	
- SA, SB, SC	Inlet: 6.935 +/-0.0075 mm (0.273 +/-0.0003 in)
	Exhaust: 6.975 +/-0.0075 mm (0.275 +/-0.0003 in)
- SD, SF	Inlet: 6.928 to 6.943 mm (0.2727 to 0.2733 in)
	Exhaust: 6.918 to 6.933 mm (0.2724 to 0.2729 in)
Valve spring free length	40.18 mm (1.581 in)
Valve guide bore diameter	
- min	6.958 mm (0.2739 in)
- max	6.968 mm (0.2743 in)
Valve face angle	
- inlet	60.5 °
- exhaust	45.17 °
Valve length	131.9 to 132.4 mm (5.193 to 5.213 in)
Valve sealing	stem seal with sealing washer
Valve head depth (below cylinder head surface)	
- inlet	0.89 to 1.39 mm (0.035 to 0.055 in)



## Section 1 - General Information Technical Data

### Inlet and Exhaust Valve Data

- exhaust	0.95 to 1.45 mm (0.037 to 0.057 in)
Valve rim thickness	2.98 to 3.38 mm (0.117 to 0.133 in)



## Rocker Levers, Rocker Shaft and Tappets Data

Valve tip clearances (measured cold):	
- SA, SB, SC	Inlet: 0.19 to 0.27 mm (0.007 to 0.011 in)
	Exhaust: 0.56 to 0.64 mm (0.022 to 0.025 in)
- SD, SF	Inlet: 0.35 mm (0.014 in)
	Exhaust: 0.56 to 0.64 mm (0.022 to 0.025 in)
Rocker lever bore diameter	
- min	26.046 mm (1.025 in)
- max	26.129 mm (1.029 in)
Rocker shaft diameter	
- min	26.00 mm (1.0236 in)
- max	26.021 mm (1.0244 in)
Tappets stem diameter	
- min	19.987 mm (0.787 in)
- max	19.975 mm (0.786 in)
Tappet bore diameter	
- min	20.00 mm (0.7874 in)
- max	20.021 mm (0.7882 in)
Tappet height (maximum)	55.25 mm (0.0218 in)





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