Open front screen

Perkins 100 Series

Models 102-05, 103-07, 103-10, 103-13, 103-15, 104-19, 104-22

WORKSHOP MANUAL

102-05 Two cylinder diesel engines

103-07
103-10
103-13
103-15 Three cylinder diesel engines

104-19
104-22 Four cylinder diesel engines

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1

General information

Introduction

This Workshop Manual has been written to provide the trained technician with enough information to service and overhaul all of the latest Perkins 100 Series engines. It has been compiled for use in conjunction with normal workshop practice and information contained in current service bulletins. Certain accepted practices have been purposely omitted in order to avoid repetition. For overhaul procedures the assumption is made that the engine is removed from the application.

How to use this manual

This manual is illustration based and is divided into 16 chapters. The illustrations in each chapter follow the sequence for the complete dismantle of a particular assembly or component. Assembly is achieved by the use of the illustrations in reverse order from the rear of the chapter. In assembly and inspection, all parts are to be thoroughly cleaned, lubricated, and where present, burrs and scale to be removed. Any open ports of high precision components, e.g. fuel injection equipment that are exposed when dismantled, must be blanked off until assembly, to prevent the ingress of foreign matter.

Where the information applies to certain types of engine only, this is indicated in the illustrations. When set screws are fitted in "through" holes into the cylinder block, a suitable sealant should be used. In this manual, when the "left" or "right" of the engine is referred to, it is that side of the engine when viewed from the flywheel end.

Special tools have been made available and a list of these is given in Chapter 16. At the start of each operation reference to the relevant special tools is made.

POWERPART consumable products are listed on page 5. At the start of each operation reference to the necessary consumable products is made.

Data and dimensions are provided as part of each operation and also in Chapter 2.

Always use the full engine number to order new parts.

Read and remember the "Safety precautions" on page 2. They are given for your protection and must be used at all times.

Danger is indicated in the text by two methods:

Warning! *This indicates that there is a possible danger to the person.*

Caution: *This indicates that there is a possible danger to the engine.*

Note: Is used where the information is important, but there is not a danger.

Safety precautions

These safety precautions are important. You must refer also to the local regulations in the country of use. Some items only refer to specific applications.

- Only use these engines in the type of application for which they have been designed.
- Do not change the specification of the engine.
- Do not smoke when you put fuel in the tank.
- Clean away any fuel which has been spilt. Material which has been contaminated by fuel must be moved to a safe place.
- Do not put diesel fuel in the tank during engine operation (unless absolutely necessary).
- Do not clean, add lubricating oil, or adjust the engine during operation (unless you have had the correct training; even then extreme caution must be used to prevent injury).
- Do not make any adjustments you do not understand.
- Ensure the engine does not run in a location where it can cause a concentration of toxic emissions. Other persons must be kept at a safe distance whilst the engine and auxiliary equipment is in operation. Do not permit loose clothing or long hair near parts which move.
- Keep away from moving parts during engine operation.

Warning! *Some parts cannot be seen clearly while the engine is running.*

- Do not run the engine with any safety guards removed.
- Do not remove the filler cap or any component of the cooling system whilst the engine is hot and while the coolant is under pressure, because dangerous hot coolant can be discharged.
- Do not use salt water in the fresh water cooling system or any other coolant which can cause corrosion.
- Do not allow sparks or fire near the batteries (especially during charging), as the gases from the electrolyte are highly flammable. The battery fluid can burn and is also dangerous to the skin and especially the eyes.
- Disconnect the battery terminals before you make a repair to the electrical system.
- Only one person must be in control of the engine. Ensure the engine is only operated from the control panel or operator’s position.
- If your skin comes into contact with high pressure fuel, get medical assistance immediately.
- Diesel fuel and used engine oils can cause skin damage to some persons. Use protection on the hands (gloves or special protection solutions).
- Do not move equipment unless the brakes are in good condition.
- Do not use ether or other starting fluids to start these engines.
- Do not wear clothing which is contaminated by lubricating oil.
- Do not put material which is contaminated with oil into the pockets of clothing.
- Discard used lubricating oil in a safe place to prevent contamination.
- Use extreme care if emergency repairs must be made in adverse conditions.
- The combustible material of some components of the engine can be extremely dangerous if burnt. Never let this material come into contact with skin or the eyes. Refer to "Viton seals" on page 10.
- Do not allow compressed air to contact the skin. If compressed air enters the skin seek medical help immediately.
- Always use a safety cage to protect the operator when a component is to be pressure tested in a container of water. Fit safety wires to secure the plugs which seal the hose connections of a component which is to be pressure tested.
- Do not clean an engine whilst it is running. If cold cleaning fluids are applied to a hot engine, certain components on the engine may be damaged.

Continued

- Ensure that the control lever of the transmission drive is in the "out of drive" position before the engine is started.
- Read and use the instructions relevant to "Engine lift equipment" on page 9.
- Do not use more than 50% anti freeze concentration by volume at high ambients, otherwise engine damage will result.
- Fit only genuine Perkins Parts.

Engine preservation

Introduction

The recommendations indicated below are designed to prevent damage to the engine when it is withdrawn from service for a prolonged period. Use these procedures after the engine is withdrawn from service. The instructions for the use of POWERPART products are given on the outside of each container.

Procedure

1 Completely clean the outside of the engine.

2 When a preservative fuel is to be used, drain the fuel system and fill it with the preservative fuel. POWERPART Lay-Up 1 can be added to the normal fuel to change it to a preservative fuel. If preservative fuel is not used, the system can be completely filled with normal fuel but the fuel must be drained and discarded at the end of the storage period together with the fuel filter canister.

3 Operate the engine until it is warm. Then correct leakages of fuel, lubricating oil or air. Stop the engine and drain the lubricating oil from the sump.

4 Renew the canister of the lubricating oil filter.

5 Fill the sump to the full mark with new and clean lubricating oil and add POWERPART Lay-up 2 to the oil to protect the engine against corrosion. If POWERPART Lay-Up 2 is not available, use a correct preservative fluid instead of the lubricating oil. If a preservative fluid is used, this must be drained and the lubricating oil sump must be filled to the correct level with normal lubricating oil at the end of the storage period.

6 Drain the coolant circuit, refer to "How to drain the cooling system" on page 23. In order to protect the cooling system against corrosion, fill it with an approved antifreeze mixture because this gives protection against corrosion, refer to "Coolant specification" on page 41.

Caution: *Certain corrosion inhibitor mixtures could cause damage to some engine components. It is recommended that you consult the Perkins Service Department, Peterborough.*

7 Operate the engine for a short period in order to circulate the lubricating oil and the coolant in the engine.

8 Disconnect the battery. Then put the battery into safe storage in a fully charged condition. Before the battery is put into storage, protect its terminals against corrosion. POWERPART Lay-Up 3 can be used on the terminals.

9 Clean the engine breather pipe (if one is fitted) and seal the end of the pipe.

10 Remove the atomisers and spray POWERPART Lay-Up 2 for one to two seconds into each cylinder bore with the piston at BDC.

Slowly turn the crankshaft one revolution and then fit the atomisers, complete with new seat washers.

11 Remove the air filter. Then, if necessary, remove the pipe installed between the air filter and the induction manifold. Release the cap screws and remove the rocker cover. Spray POWERPART Lay-Up 2 around the rocker shaft assembly and into the induction ports in the cylinder head, as indicated on the container label. Fit the rocker cover. Seal the manifold with waterproof tape.

12 Remove the exhaust pipe. Spray POWERPART Lay-Up 2 into the exhaust manifold. Seal the manifold with waterproof tape.

13 Seal the vent pipe of the fuel tank or the fuel filler cap with waterproof tape.

14 Remove the alternator drive belt and put it into storage.

15 In order to prevent corrosion, spray the engine with POWERPART Lay-Up 3. Do not spray the area inside the alternator cooling fan.

Caution: *After a period in storage, but before the engine is started, operate the starter motor with the stop switch (refer to illustration A under "How to start a cold engine with the fuelled starting aid" on page 17) held in the "STOP" position until oil pressure is indicated. Oil pressure is indicated when the low pressure warning light is extinguished. If a solenoid stop control is used on the fuel injection pump, it must be disconnected for this operation.*

If the engine protection is done correctly according to the above recommendations, no corrosion damage will normally occur. Perkins are not responsible for damage which may occur when an engine is in storage after a period in service.

POWERPART recommended consumable products

Perkins have made available the products recommended below in order to assist in the correct operation, service and maintenance of your engine and your machine. The instructions for the use of each product are given on the outside of each container. These products are available from your Perkins distributor.

POWERPART Anti-freeze

Protects the cooling system against frost and corrosion.

Part number 1 litre 21825166.

POWERPART Easyflush

Cleans the cooling system.

Part number 21825001.

POWERPART Lay-up 1

A diesel fuel additive for protection against corrosion.

Part number 1772204.

POWERPART Lay-up 2

Protects the inside of the engine and other closed systems.

Part number 1762811.

POWERPART Lay-up 3

Protects outside metal parts.

Part number 1734115.

POWERPART Chisel

Allows easy removal of old gaskets and joints.

Part number 21825163.

POWERPART Repel

Dries damp equipment and gives protection against corrosion. Passes through dirt and corrosion to lubricate and to assist removal of components.

Part number 21825164.

POWERPART Threadlock (pipe)

To retain and seal pipe connections with coarse threads. Pressure systems can be used immediately.

Part number 21820575.

POWERPART Platelock

For tight fitted metal surfaces. Suitable for metal plated surfaces and stainless steel.

Part number 21826039.

POWERPART Silicone gasket sealant

Silicone adhesive used for sealing where oil or water resistance is needed.

Part number 21826046.

Engine I.D. location

The engine identification plate (A1) is located on the front right side of the engine, just above the fuel injection pump.

It consists of the following:

Abbreviations and codes

Engine build list (parts list) numbering system

The standard engine parts list numbering code system is defined as follows:

Code	I	II	III	IV	V
Example	KE	30260	U	000001	D

Code I Engine Build Code

Engine	Build code	Engine	Build code
102 - 05	KN	103 - 15	KE
103 - 07	KL	104 - 19	KF
103 - 10	KD	104 - 22	KR
103 - 13	KH		

Code II Engine parts list

Parts list increases numerically for both OEMS and distributors.

Code III Country of manufacture

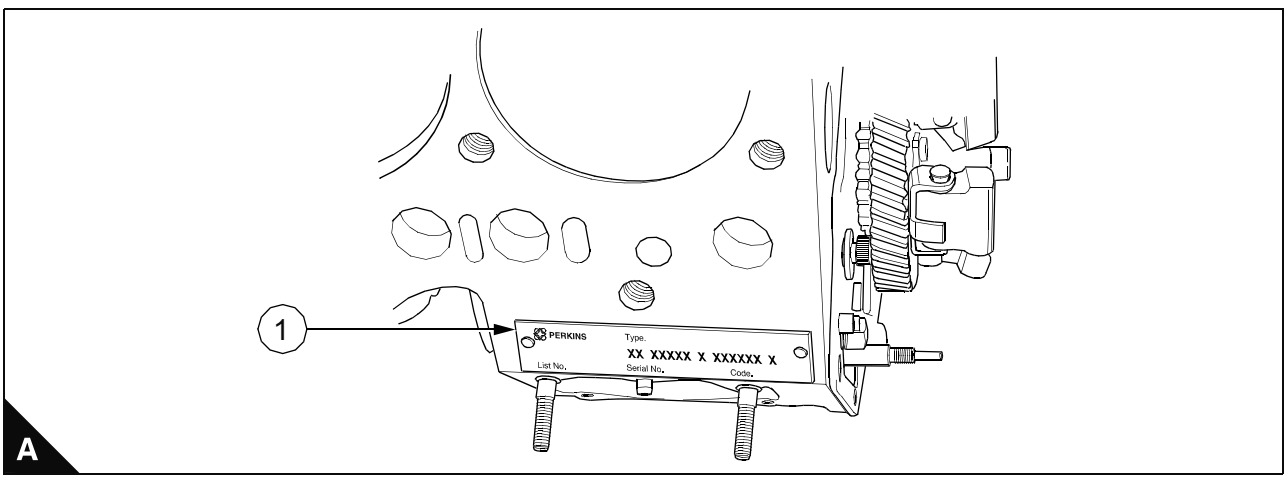
Code	Country of manufacture
J	Made in Japan
U	Made in U.K.

Code IV Engine serial number

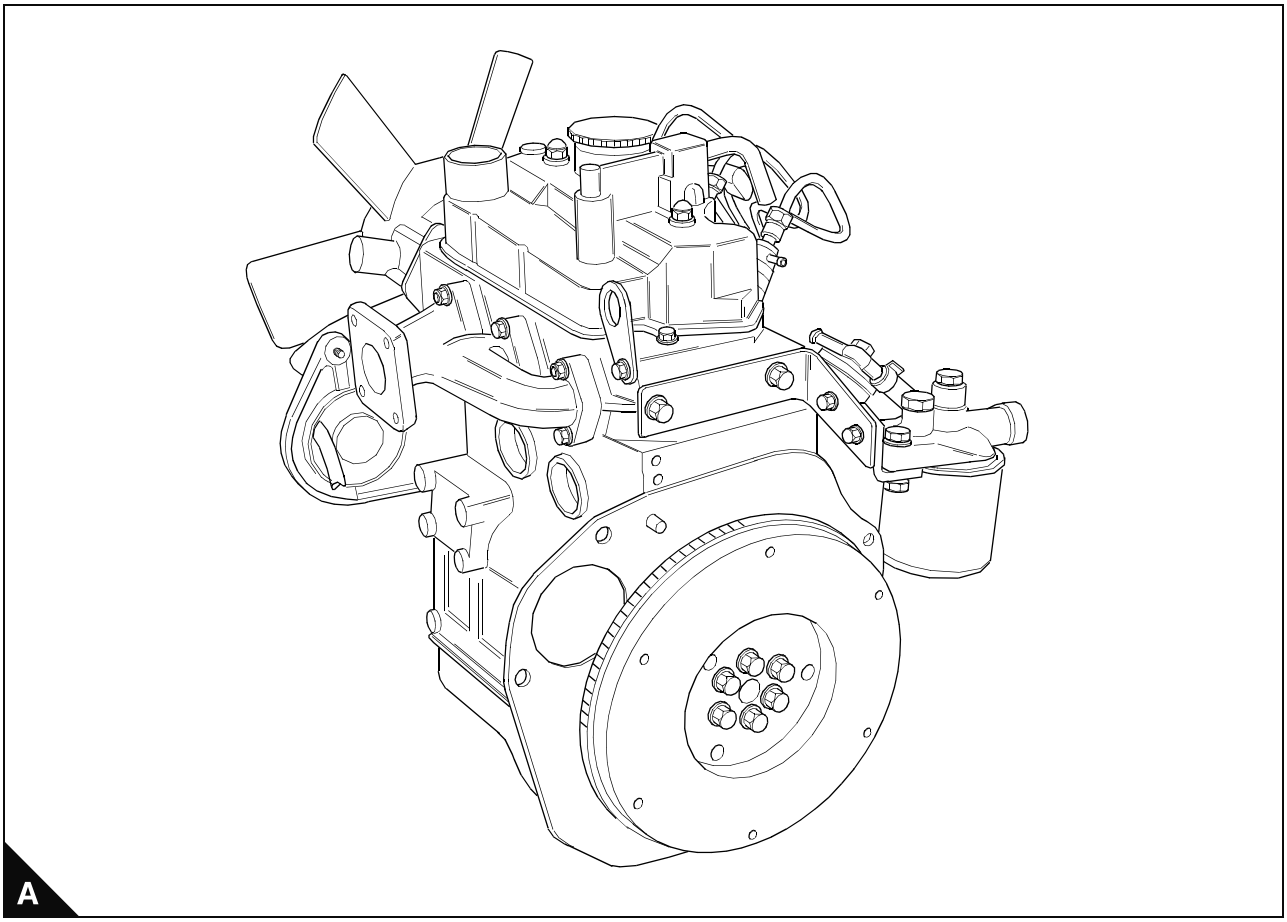
Individual engine serial number commencing with 000001 increasing numerically.

Code V Year of Manufacture

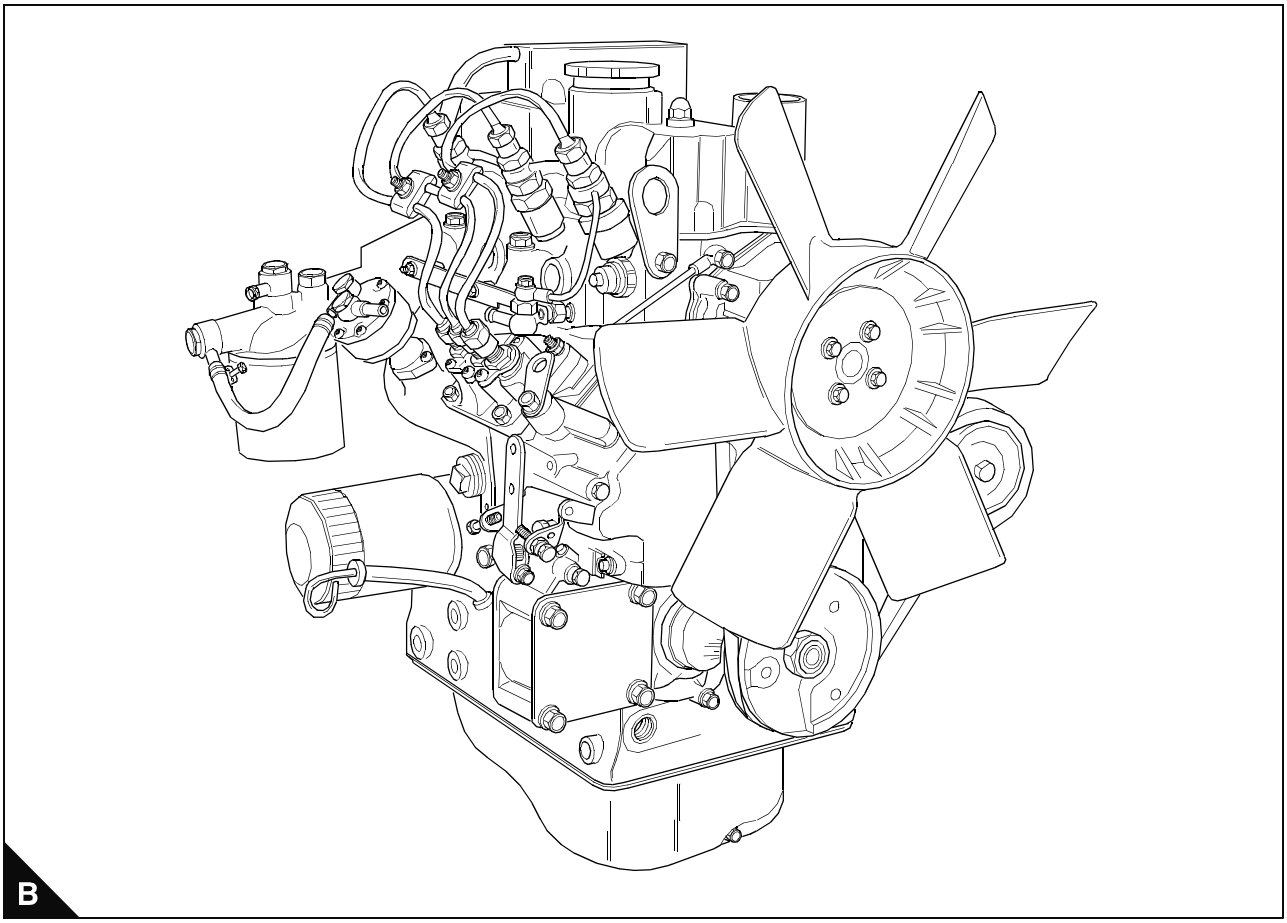
Code	Year	Code	Year	Code	Year	Code	Year	Code	Year
M	1985	Q/S	1988	W	1992	B	1996	F	2000
N	1986	T	1989	X	1993	C	1997	G	2001
O	not used	U	1990	Y	1994	D	1998	H	2002
P	1987	V	1991	A	1995	E	1999		



Engine views - 3 cylinder front and rear

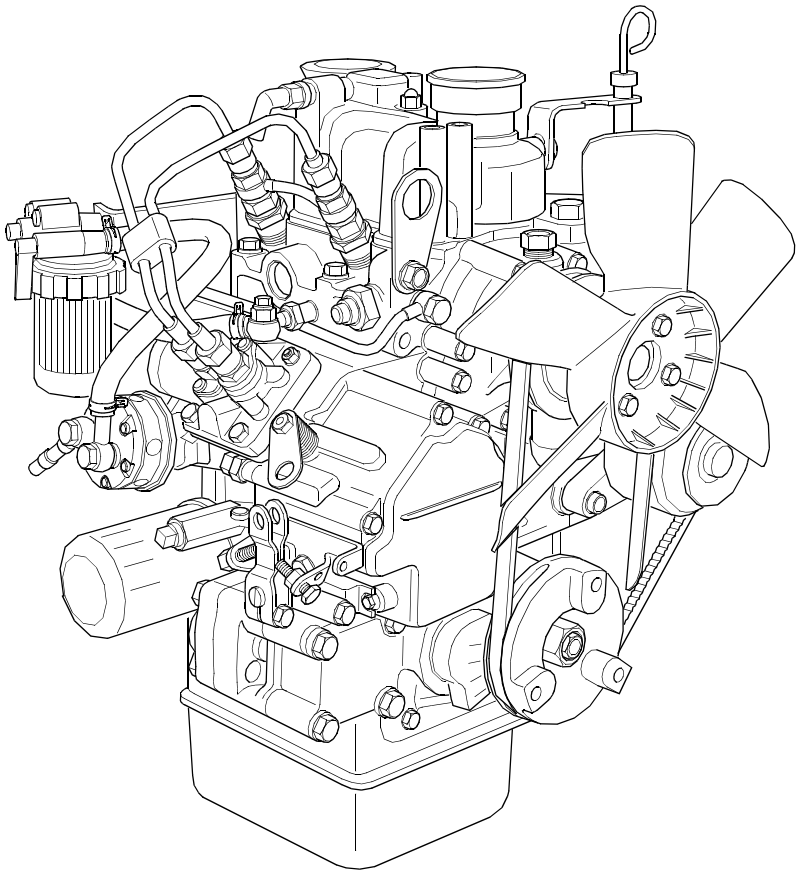


A



B

Engine views - 2 cylinder front and 4 cylinder front



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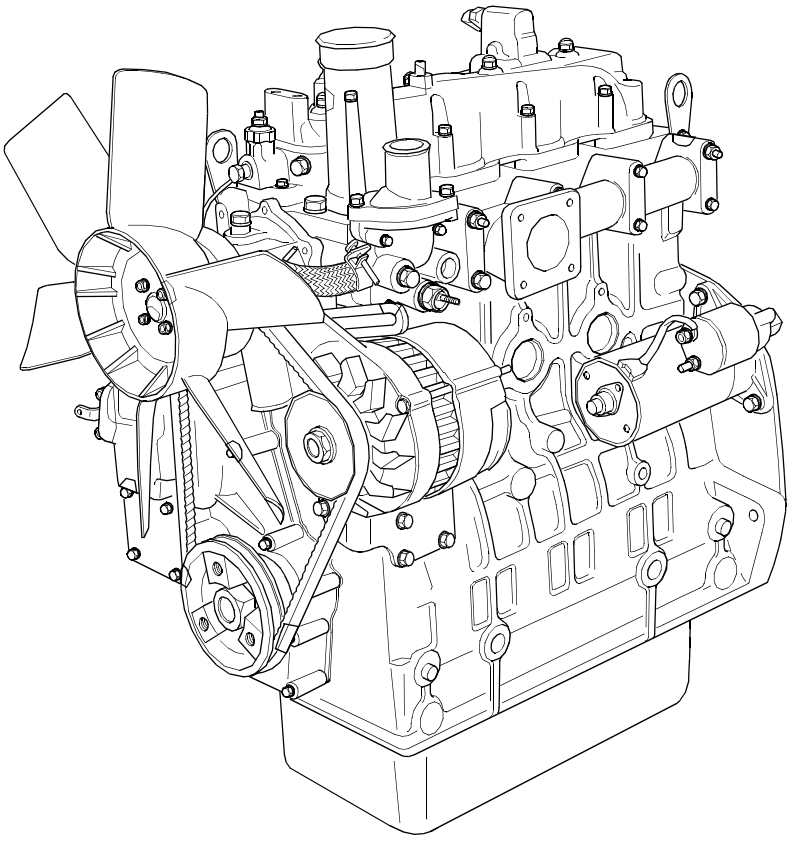


B

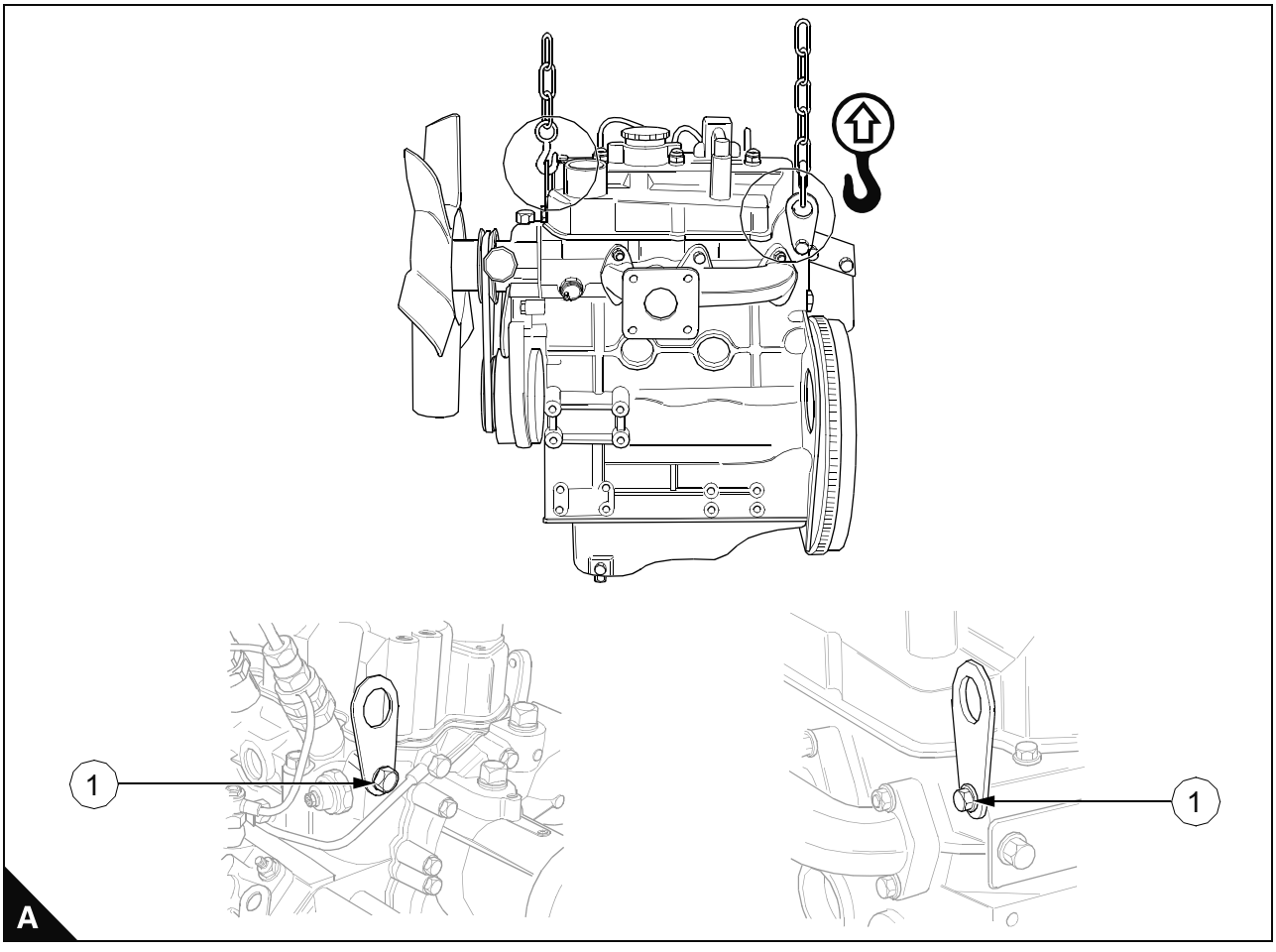
Engine lift equipment

Special requirements

Torque Nm (lbf ft) kgf m	
Lifting hook bolts (A1)	26 (19) 2,6

Maximum engine weights (dry) with flywheel and housing fitted

Engine model	102-05	103-07	103-10	103-13	103-15	104-19	104-22
Engine build code	KN	KL	KD	KH	KE	KF	KR
Max engine weight	79 kg	87 kg	111 kg	164 kg	176 kg	207 kg	220 kg



Viton seals

Some seals used in engines and in components fitted to engines are made of Viton.

Viton is used by many manufacturers and is a safe material under normal conditions of operation.

If Viton is burned, a product of this burnt material is an acid which is extremely dangerous. Never allow this burnt material to come into contact with the skin or with the eyes.

If it is necessary to come into contact with components which have been burnt, ensure that the precautions which follow are used:

- Ensure that the components have cooled.
- Use neoprene gloves and discard the gloves safely after use.
- Wash the area with calcium hydroxide solution and then with clean water.
- Disposal of components and gloves which are contaminated must be in accordance with local regulations.

Warning! *If there is contamination of the skin or eyes, wash the affected area with a continuous supply of clean water or with calcium hydroxide solution for 15-60 minutes. Obtain immediate medical attention.*

Compression test data

Tests have shown that many factors affect compression pressures. Battery, starter motor condition, ambient conditions and the type of gauge used can give a wide variation of results for a given engine.

Engine model	Pressure kPa (lbf/in²)	
	Standard	To be repaired
102-05, 103-07, 103-10, 103-13	>2940 (426.6) @ 200 rev/min	<2450 (355.5)
103-15, 104-19, 104-22	>2940 (426.6) @ 250 rev/min	<2450 (355.5)

A compression test should only be used to compare between cylinders of an engine. If one or more cylinders vary by more than 350 KPa (50 lbf/in²) then those cylinders may be faulty.

A compression test should not be the only method used to show the condition of an engine, but it should be used together with other symptoms and tests.

How to do a compression test

Note: Before the compression test, ensure that the battery is in good condition and that it is fully charged. Also ensure that the starter motor is in good condition.

1 To ensure that the engine cannot start, disconnect the engine stop solenoid or ensure the engine stop control is in the 'stop' position.

2 Ensure that the valve tip clearances are set correctly.

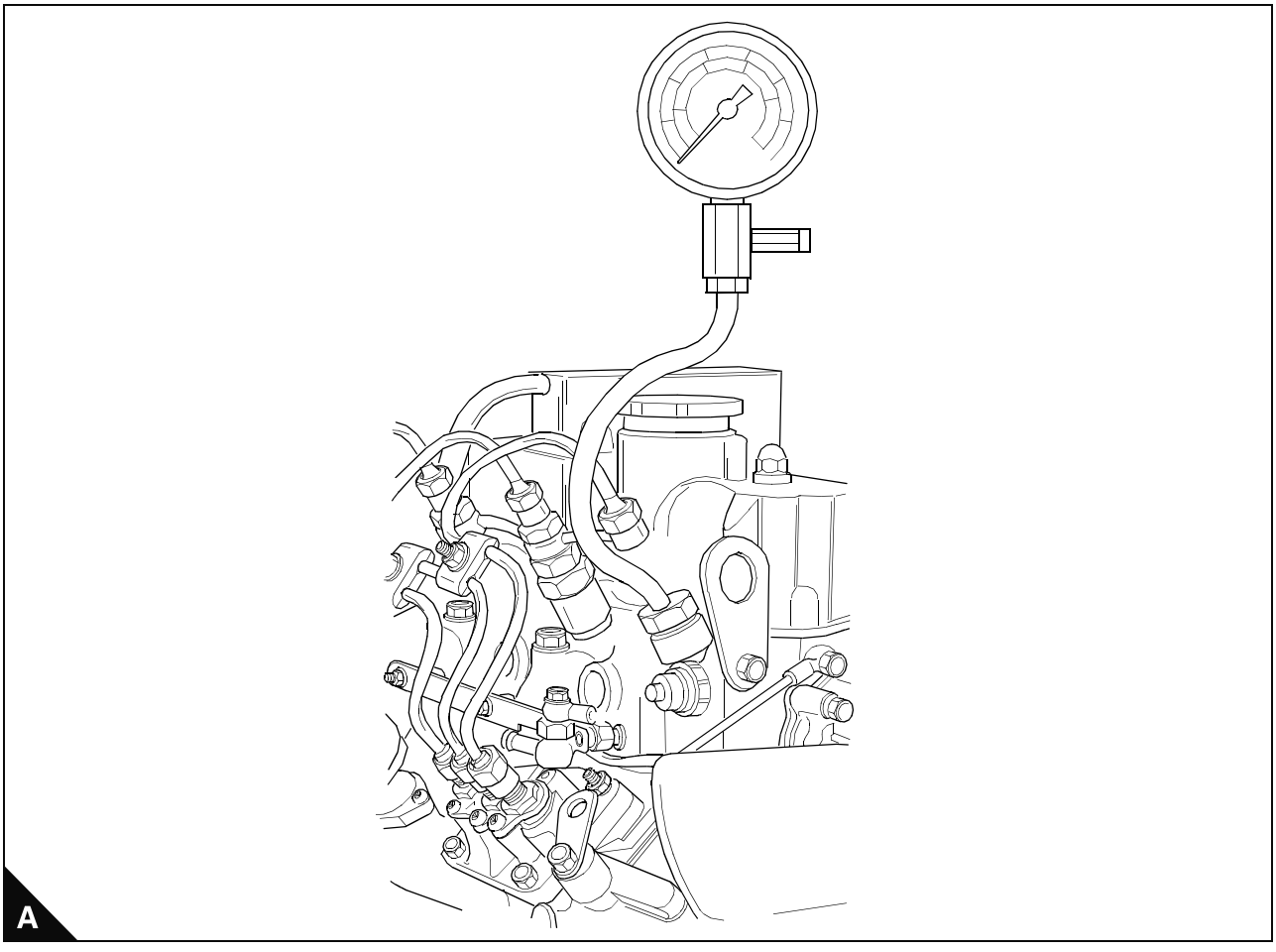
3 Remove the atomisers.

4 Fit a suitable gauge into the atomiser hole of the cylinder to be tested.

Note: .

5 Operate the starter motor and record the pressure indicated on the gauge.

6 Repeat for each cylinder.



A

2

Specifications

Basic engine data

Engine model	102-05	103-07	103-10	103-13	103-15	104-19	104-22
Engine build code	KN	KL	KD	KH	KE	KF	KR
Number of cylinders	2	3	3	3	3	4	4
Cylinder arrangement and cycle	Vertical in line, four stroke cycle						
Direction of rotation	Clockwise, viewed from front						
Induction system	Naturally aspirated						
Combustion system	IDI special swirl						
Nominal bore	67 mm (2.6 in)	67 mm (2.6 in)	75 mm (2.9 in)	84 mm (3.3 in)	84 mm (3.3 in)	84 mm (3.3 in)	84 mm (3.3 in)
Stroke	64 mm (2.5 in)	64 mm (2.5 in)	72 mm (2.8 in)	80 mm (3.1 in)	90 mm (3.5 in)	90 mm (3.5 in)	100 mm (3.9 in)
Compression ratio	24:1	24:1	23:1	22:1	22.5:1	22:1	22:1
Cubic capacity	0,451 ltrs. (27.5 in^3)	0,676 ltrs. (41.2 in^3)	0,954 ltrs. (58.2 in^3)	1,330 ltrs. (81.1 in^3)	1,496 ltrs. (91.2 in^3)	1,995 ltrs. (121.7 in^3)	2,216 ltrs. (135.2 in^3)
Firing order	1, 2	1, 2, 3	1, 2, 3	1, 2, 3	1, 2, 3	1, 3, 4, 2	1, 3, 4, 2
Oil pressure relief	262-359 KPa						352-448 KPa
Oil pressure switch	29,6 KPa						
Valve tip clearance (cold)							
-Inlet	0,2 mm (0.0078 in)						
-Exhaust	0,2 mm (0.0078 in)						
Electrical system	12 volt						
Governor	Mechanical all speed						
Fuel injection	Cassette type fuel injection system						

Recommended torque tensions

Most of the torques on the engine are standard. Torques specific to individual operations are listed in the relevant operation. The standard torques listed in the tables below can be used when a specific torque is not necessary.

Note: The torques below apply to components lubricated lightly with clean engine oil before they are fitted.

Standard torques for setscrews, studs and nuts

Thread size	Bolt Strength	Coarse Screw Thread				Fine Screw Thread			
		Pitch (mm)	Torque (Nm)	Torque (lbf ft)	Torque (kgf m)	Pitch (mm)	Torque (Nm)	Torque (lbf ft)	Torque (kgf m)
M4	8.8 11T	0,7	3 4	2 3	0,3 0,4				
M5	8.8 11T	0,8	6 8	4 6	0,6 0,8				
M6	8.8 11T	1,0	10 14	7 10	1,0 1,4				
M8	8.8 11T	1,25	26 32	19 24	2,7 3,3	1,0	30 35	22 26	3,0 3,6
M10	8.8 11T	1,5	50 62	37 46	5,1 6,3	1,25	56 66	41 49	5,7 6,7
M12	8.8 11T	1,75	75 104	55 77	7,6 10,6	1,25	84 113	62 83	8,6 11,5
M14	8.8 11T	2,0	118 157	87 116	12,0 16,0	1,5	132 167	97 123	13,5 17,0
M16	8.8 11T	2,0	167 230	123 170	17,0 23,4	1,5	175 245	129 181	17,8 20,5

Examples of applicable material

Bolt Strength	Example
8.8 11T	S45C SCM435

Data and dimensions

Note: The information in this Workshop Manual is given as a guide for personnel engaged on engine overhauls. The dimensions which are shown are those which are mainly used in production.

Injection timing

Engine build list	Engine type	Injection timing
KN30305, KN30306 KN30308, KN30309	102-05	25.5° ± 1°
KN30304, KN30327	102-05	27.5° ± 1°
KL30317, KL30318 KL30319, KL30320 KL30323, KL30324 KL30325, KL30326	103-07	17.0° ± 1°
KD30238, KD30239 KD30240	103-10	23.0° ± 1°
KD30241, KD30242 KD30247, KD30248	103-10	22.5° ± 1°
KD30245, KD30246	103-10	18.5° ± 1°
KH30255, KH30256 KH30273	103-13	22.5° ± 1°
KE30260, KE30261 KE30274	103-15	22.5° ± 1°
KE30262, KE30263	103-15	16.0° ± 1°
KF30265, KF30266 KF30276	104-19	21.5° ± 1°
KR30334, KR30335	104-22	16.0° ± 1°
KR30331, KR30332 KR30333	104-22	20.0° ± 1°

Note: OEM build lists can be found on the relevant service bulletin. If the timing is incorrect refer to "Fuel injection pump timing" on page 79.

Cylinder bore dimensions

Engine model/Block specification	Bore dimension mm (in)	
	Standard	Service limit
102-05, 103-07		
New Block	67,000 - 67,019 (2.63780 - 2.63854)	67,2 (2.646)
1st oversize bore 0,5 mm (0.2 in)	67,500 - 67,519 (2.65750 - 2.65822)	67,7 (2.666)
2nd oversize bore 0,5 mm (0.2 in)	68,000 - 68,019 (2.67720 - 2.67791)	68,2 (2.685)
103-10		
New Block	75,000 - 75,019 (2.95280 - 2.95350)	75,2 (2.961)
1st oversize bore 0,5 mm (0.2 in)	75,500 - 75,519 (2.97244 - 2.97318)	75,7 (2.981)
2nd oversize bore 0,5 mm (0.2 in)	76,000 - 76,019 (2.99212 - 2.99287)	76,2 (2.999)
103-13, 103-15, 104-19, 104-22		
New Block	84,000 - 84,019 (3.30710 - 3.30783)	84,2 (3.315)
1st oversize bore 0,5 mm (0.2 in)	84,500 - 84,519 (3.32677 - 3.32751)	84,7 (3.335)
2nd oversize bore 0,5 mm (0.2 in)	85,000 - 85,019 (3.34650 - 3.34719)	85,2 (3.354)

Caution: *When service limits are exceeded following a second oversize bore operation, the block* ***must*** *be renewed.*

Piston and piston ring dimensions

Piston

If the outer surface of the piston is excessively damaged (cracked, scored, or it shows signs of being burnt etc.) it must be renewed.

Piston skirt

1 Check the larger diameter of the piston skirt (10 mm from bottom) with reference to the following tables.

102-05, 103-07, 103-10, 103-13

Piston size	Diameter mm (in)		
	102-05, 103-07	103-10	103-13
Standard	66,9375 - 66,9525 (2.6353- 2.6359)	74,9325 - 74,9475 (2.950100 - 2.950690)	83,948 - 83,963 (3.30503 - 3.30562)
0,5 mm oversize	67,4375 - 67,4525 (2.6550 - 2.6556)	75,4325 - 75,4475 (2.969780 - 2.970370)	84,448 - 84,463 (3.32472 - 3.32531)
1,0 mm oversize	Not applicable	75,9325 - 75,9475 (2.989463 - 2.990060)	84,948 - 84,963 (3.34440 - 3.34499)

103-15, 104-19, 104-22

Piston size	Diameter mm (in)	
	103-15, 104-19	104-22
Standard	83,948 - 83,963 (3.30503 - 3.30567)	83,948 - 83,963 (3.30503 - 3.30562)
0,5 mm oversize	84,448 - 84,463 (3.32472 - 3.32531)	84,448 - 84,463 (3.32472 - 3.32531)
1,0 mm oversize	84,948 - 84,963 (3.34440 - 3.34499)	84,948 - 84,963 (3.34440 - 3.34499)

2 Check inside diameter (thrust direction) of the cylinder.

Engine model	Diameter mm (in)	
	Standard	Service limit
102-05, 103-07	66,9375 - 66,9525 (2.6353 - 2.6359)	66,7 (2.626)
103-10	74,9325 - 74,9475 (2.950100 - 2.950690)	74,7 (2.941)
103-13, 103-15, 104-19, 104-22	83,948 - 83,963 (3.30503 - 3.30562)	83,7 (3.295)

3 Calculate the clearance between the cylinder and piston. If this clearance is more than standard, or the piston diameter is less than the service limit, renew the piston.

Engine model	Clearance mm (in)	
	Standard	Service limit
102-05, 103-07	0,048 - 0,082 (0.00189 - 0.00323)	0,25 (0.010)
103-10	0,0525 - 0,0865 (0.002070 - 0.003406)	0,25 (0.010)
103-13, 103-15, 104-19, 104-22	0,038 - 0,072 (0.00150 - 0.00283)	0,25 (0.010)

Oversized piston

When the cylinder is oversized, ensure that the correct oversized piston and piston ring set is used.

Note: Ring sets are available for all pistons listed above.

Gudgeon pin

1 Check the outside diameter of the gudgeon pin. If it is less than the service limit, renew the pin.

Engine model	Diameter mm (in)	
	Standard	Service limit
102-05, 103-07	18,998 - 19,002 (0.74795 - 0.74811)	18,98 (0.7472)
103-10	20,998 - 21,002 (0.82669 - 0.82685)	20,98 (0.8259)
103-13	24,996 - 25,00 (0.98410 - 0.98425)	24,98 (0.9835)
103-15	27,996 - 28,000 (1.10220 - 1.10240)	27,98 (1.1016)
104-19	27,996 - 28,000 (1.10220 - 1.10240)	27,98 (1.1016)
104-22	27,996 - 28,000 (1.10220 - 1.10240)	27,98 (1.1016)

2 Check the clearance between gudgeon pin hole and gudgeon pin. Check the inside diameter of the gudgeon pin hole and the outside diameter of the gudgeon pin, and calculate the clearance between them. If the clearance is more than the service limit, renew the piston and gudgeon pin.

Engine model	Clearance mm (in)	
	Standard	Service limit
102-05, 103-07, 103-10	-0,004 to +0,004 (-0.00016 to +0.00016)	0,02 (0.0008)
103-13, 103-15, 104-19, 104-22	-0,001 to +0,007 (-0.00040 to +0.00030)	0,02 (0.0008)

Crankshaft deflection

1 Support the crankshaft with a V-block.

2 Position a dial gauge on the crankshaft centre journal, and turn the crankshaft gradually by one full turn.

3 If the gauge reading is more than the service limit correction or replacement of the crankshaft is needed.

Deflection mm (in)	
Standard	**Service limit**
0,03 or less (0.011)	0,06 (0.0023)

4 If measured diameter is less than the service limit, correct by grinding and use undersized bearings and bush.

Crankshaft inspection

1 Check the oil seal contact face for damage or wear.

2 Check oil holes for blockage.

3 Check crankshaft journal (A4) and pin (A3) for stepped wear. Take measurements of diameters (A5-A5) and (A6-A6) at positions (A1) and (A2). If the maximum difference between the measurements (stepped wear) is more than the service limit of 0,05 mm (0.0019 in) then correction is required.

Grinding specification

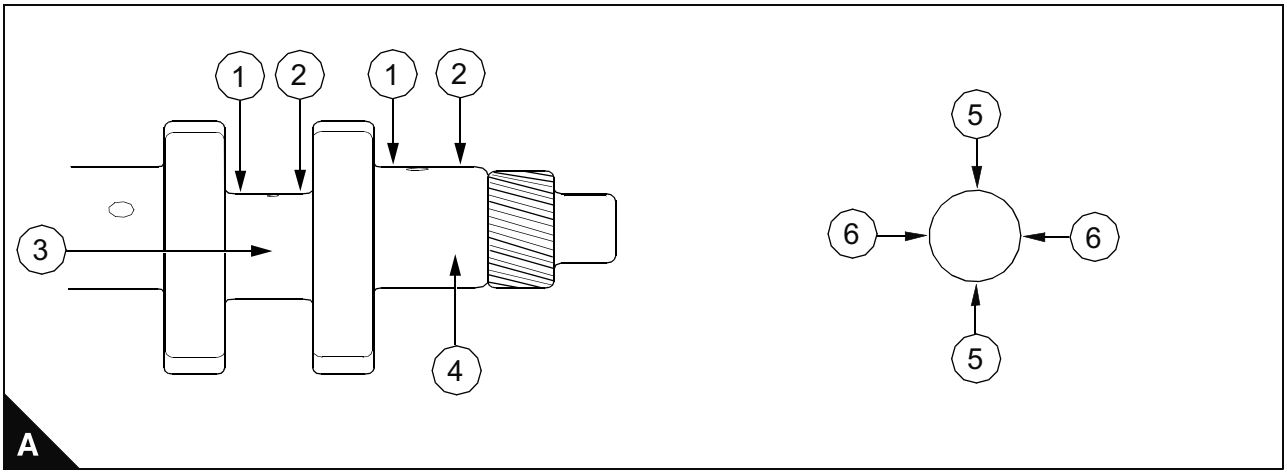
When grinding the crankshaft, work with the following specifications:

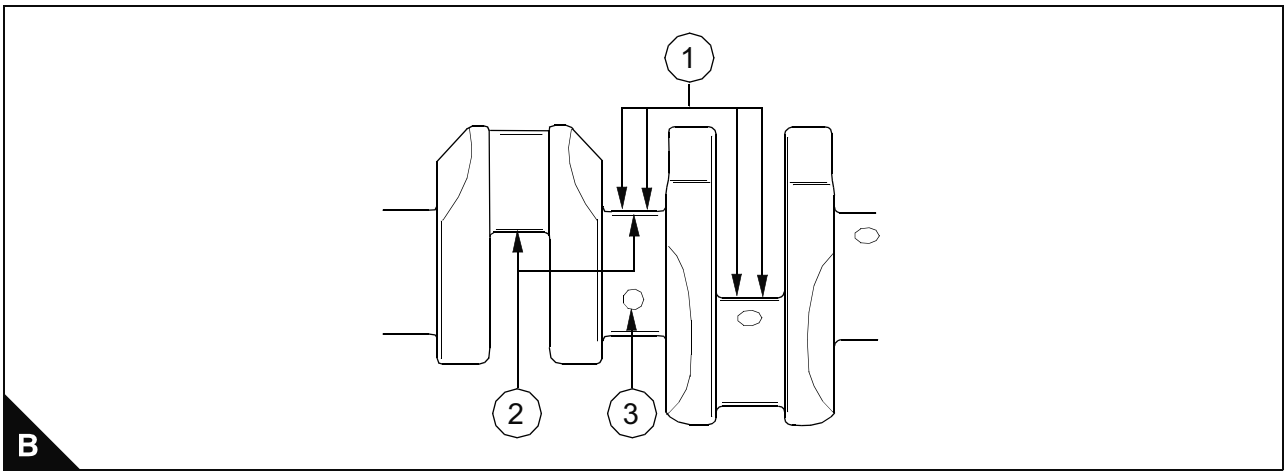
Radius at pin/journal (B1): 3 mm ± 0,2 mm (0.118 in ± 0.0078 in).

Finish precision (B2): 1.6Z

Radius around oil hole (B3): 2 mm (0.0787 in) maximum/5 mm (0.196 in) minimum.

Note: Use No. 400 emery cloth for final polishing.





Crankshaft journal diameters

Engine model/Journal type	Journal No.	Diameter mm (in)	
		Standard	Service limit
102-05			
Standard	1	42,964 - 42,975 (1.69150 - 1.69193)	42,90 (1.689)
	2	45,948 - 45,959 (1.80897 - 1.80941)	45,90 (1.807)
Undersize 0,25 mm (0.01 in)	1	42,714 - 42,725 (1.68165 - 1.68210)	42,65 (1.679)
	2	45,698 - 45,709 (1.79913 - 1.79960)	45,65 (1.797)
Undersize 0,50 mm (0.02 in)	1	42,464 - 42,475 (1.67181 - 1.67224)	42,40 (1.669) (1)
	2	45,448 - 45,459 (1.78930 - 1.78972)	45,40 (1.787) (1)
103-07			
Standard	1, 2	42,964 - 42,975 (1.69150 - 1.69193)	42,90 (1.689)
	3	45,948 - 45,959 (1.80897 - 1.80941)	45,90 (1.807)
Undersize 0,25 mm (0.01 in)	1, 2	42,714 - 42,725 (1.68165 - 1.68210)	42,65 (1.679)
	3	45,698 - 45,709 (1.79913 - 1.79960)	45,65 (1.797)
Undersize 0,50 mm (0.02 in)	1, 2	42,464 - 42,475 (1.67181 - 1.67224)	42,40 (1.669) (1)
	3	45,448 - 45,459 (1.78930 - 1.78972)	45,40 (1.787) (1)
103-10			
Standard	1, 2, 3	45,964 - 45,975 (1.80960 - 1.81004)	45,90 (1.807)
Undersize 0,25 mm (0.01 in)	1, 2, 3	45,714 - 45,725 (1.79980 - 1.80020)	45,65 (1.797)
Undersize 0,50 mm (0.02 in)	1, 2, 3	45,464 - 45,475 (1.78992 - 1.79035)	45,40 (1.787) (1)
103-13			
Standard	1, 2, 3	57,957 - 57,970 (2.28177 - 2.28228)	57,9 (2.280)
Undersize 0,25 mm (0.01 in)	1, 2, 3	57,707 - 57,720 (2.27192 - 2.27244)	57,6 (2.268)
Undersize 0,50 mm (0.02 in)	1, 2, 3	57,457 - 57,470 (2.26210 - 2.26260)	57,4 (2.260) (1)
103-15			
Standard	1, 2, 3	67,957 - 67,970 (2.67550 - 2.67597)	67,90 (2.6732)
Undersize 0,25 mm (0.01 in)	1, 2, 3	67,707 - 67,720 (2.66563 - 2.66614)	67,65 (2.6634)
Undersize 0,50 mm (0.02 in)	1, 2, 3	67,457 - 67,470 (2.65579 - 2.65630)	67,40 (2.6535) (1)
104-19, 104-22			
Standard	1, 2, 3, 4	67,957 - 67,970 (2.67550 - 2.67597)	67,90 (2.6732)
Undersize 0,25 mm (0.01 in)	1, 2, 3, 4	67,707 - 67,720 (2.66563 - 2.66614)	67,65 (2.6634)
Undersize 0,50 mm (0.02 in)	1, 2, 3, 4	67,457 - 67,470 (2.65579 - 2.65630)	67,40 (2.6535) (1)

(1) If the diameter is less than this value, the crankshaft must be renewed.