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						

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3

Cylinder head assembly

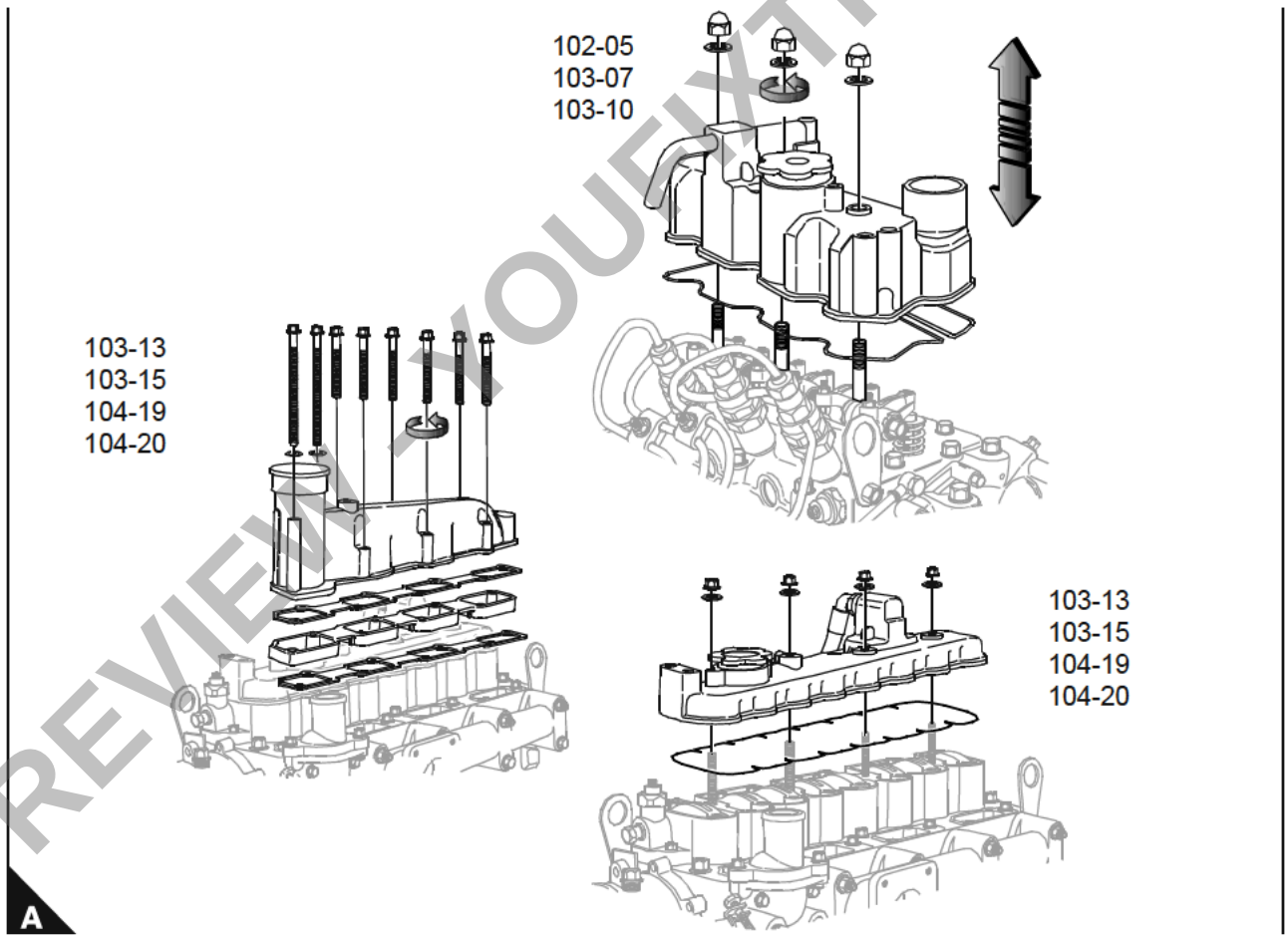
Rocker cover and inlet manifold

To remove and to fit **Operation 3-1**

Special requirements

Torque Nm (lbf ft) kgf m	
102-05, 103-07, 103-10	11 (8) 1,1
103-13, 103-15	10 (7) 1,0
104-19, 104-22	14 (10) 1,4

Note: Inspect the joint, renew if necessary.



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Thread Sealant

When setscrews or studs are fitted into holes which are tapped through the cylinder block, a suitable sealant must be used to prevent leakage.

Micro encapsulated anaerobic sealant (M.E.A.S) fasteners have been introduced instead of jointing compounds or other sealants when the fasteners are fitted in through holes into oil or coolant passages. The identification of these fasteners, as supplied, is by a red, blue, or other colour sealant around the fastener threads.

With M.E.A.S. sealed studs, the sealed end must be fitted into the cylinder head / cylinder block etc. Ensure that the threaded holes have a 1,59 mm (0.0625 in) 45° chamfer, to ensure that when the new fasteners are fitted the M.E.A.S. sealant is not removed. If the fasteners have to be removed and fitted again, the threads must be cleaned and a suitable sealant used.

Note: New setscrews have sealant applied by the manufacturer to the first 13,0 mm (0.50 in) of the threads. If the setscrews are to be used again, clean the old sealant from the male and female threads and apply new sealant, (Powerpart Threadlock and Nutlock) to the setscrews.

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

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Wiring diagram 14 and 15 amp alternator - 102-05, 103-07, 103-10

Circuit	Cable number	Circuit current	Maximum circuit resistance	Maximum circuit volt drop	Remarks
Alternator charging	4 / 7 8 9 13	14 amp (2 cyl) 15 amp (3 cyl)	0.036 Ù (2 cyl) 0.033 Ù (3 cyl)	0.5 Volt	See Glow Plugs Circuit
Starter motor solenoid	4 5 6	15.75 amp	0.04 Ù	0.63 Volt	See Glow Plugs Circuit
STD glow plugs (via glow signal)	4 / 5 10 11 12	(Peak max) 26 amp (2 cyl) 39 amp (3 cyl)	0.0192 Ù (2 cyl) 0.0128 Ù (3 cyl)	0.5 Volt	

Wiring diagram maximum circuit resistance

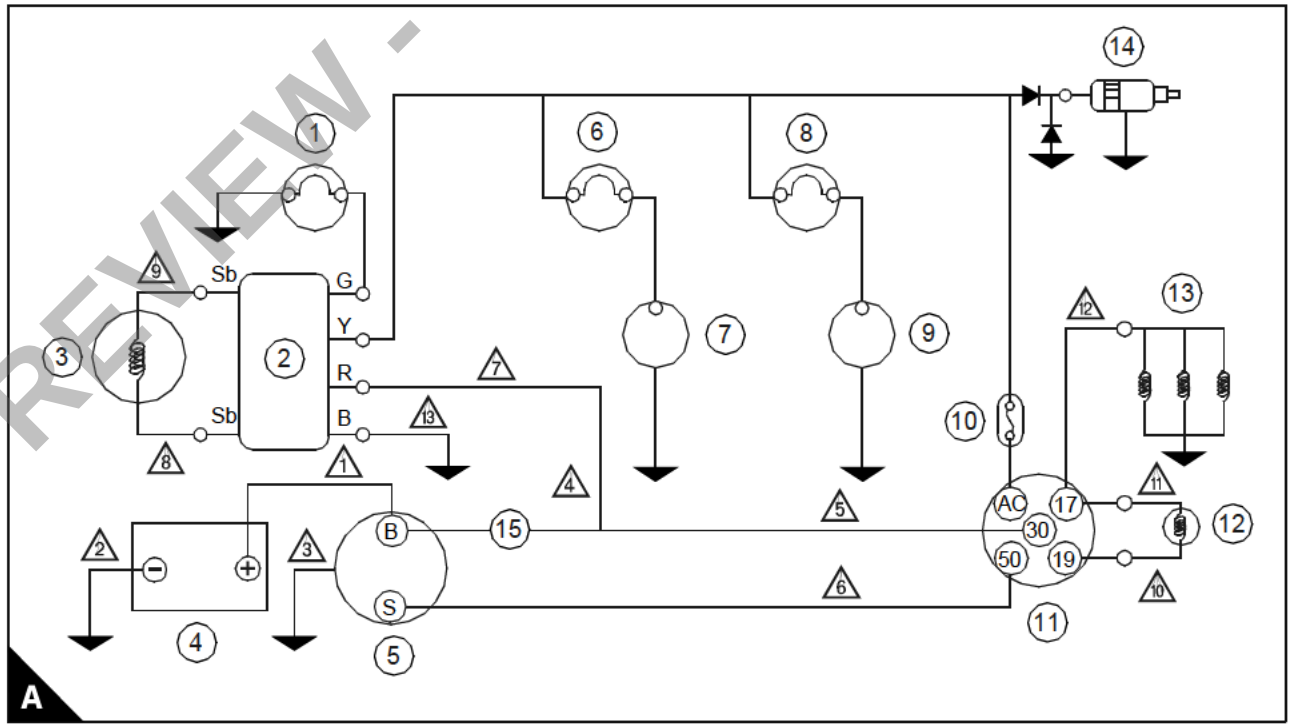
The resistance of battery cables 1, 2 and 3 must not exceed 0.0018 Ù.

Note: If a glow signal is not used - it is still necessary to connect terminal 19 and 17 on the switch.

1 Alternator warning lamp
2 Regulator
3 Alternator
4 Battery
5 Starter motor
6 Oil pressure warning lamp
7 Oil pressure switch (1)
8 Water temperature warning lamp
9 Thermostat switch
10 Fuse
11 Key switch
12 Glow signal
13 Glow plugs
14 Solenoid switch
15 A delayed fuse can be fitted if required

(1) Max current draw for standard oil pressure switch is 0.42 amps (5 Watt lamp max).

= Diode. Capacity: Current 3 amp. Reverse Voltage: 600V. **(This is mandatory)**.



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Rocker shaft (102-05, 103-07, 103-10)

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Rocker shaft (103-13, 103-15, 104-19, 104-22)

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To remove and to fit **Operation 3-9**

Special requirements

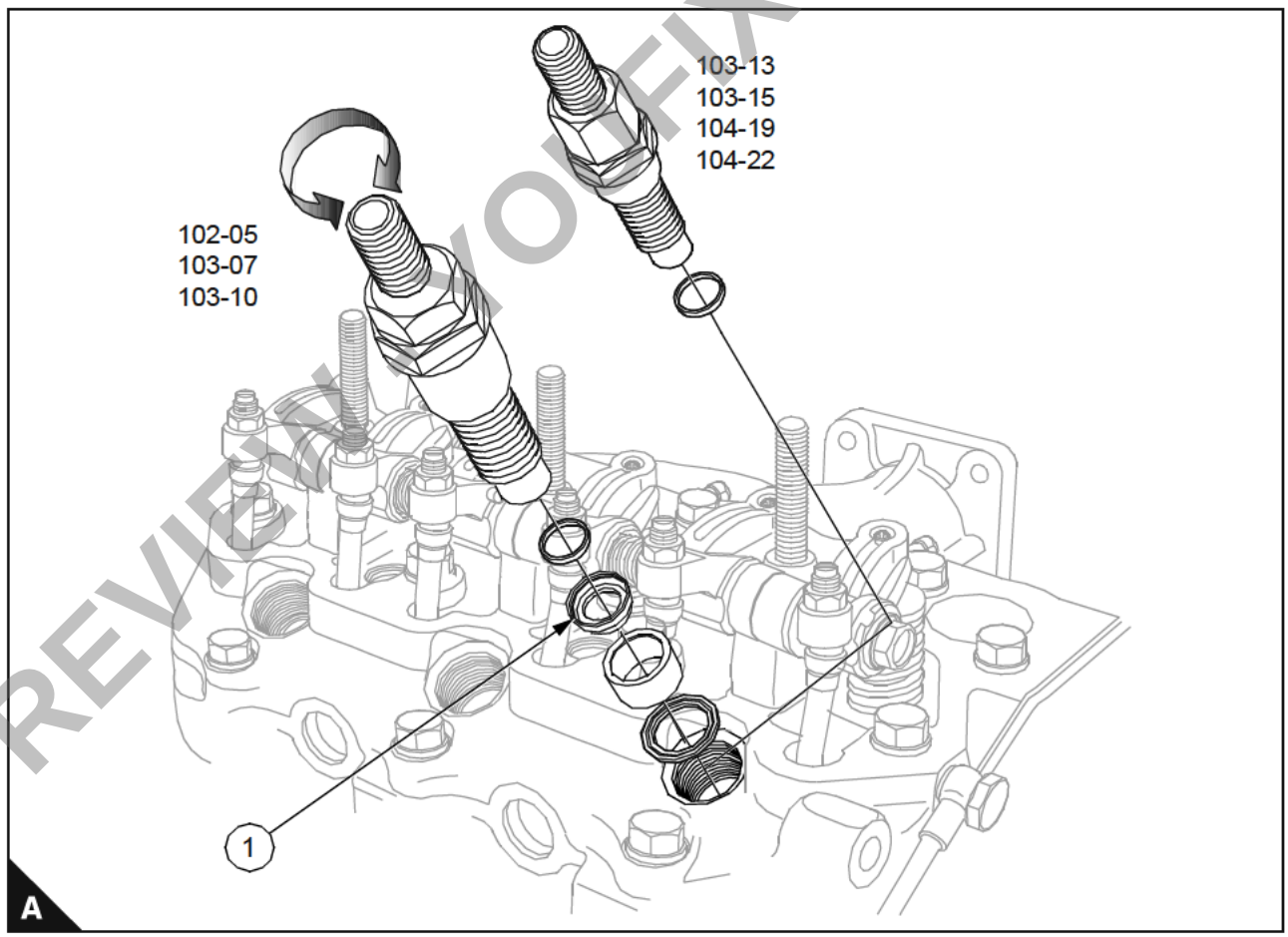
Torque Nm (lbf ft) kgf m		Test Pressure kgf/cm² (lbf/in²) ats	
102-05, 103-07	64 (47) 6,5	102-05, 103-07	120 (1707) 116
103-10	81 (60) 8,2	103-10	120 (1707) 116
103-13, 103-15, 104-19, 104-22	64 (47) 6,5	103-13, 103-15, 104-19, 104-22	150 (2133) 145

***Cautions*:**

- *Deep sockets should always be used during this procedure.*
- *Connections should be blanked off until assembly.*

Notes:

- Item (A1) is used on 103-10 engines only.
- For emissions approved engines. It is essential that the fuel adjustment screw is not altered from the original setting.
- For emissions approved engines. The maximum No Load Speed must be checked after assembly.



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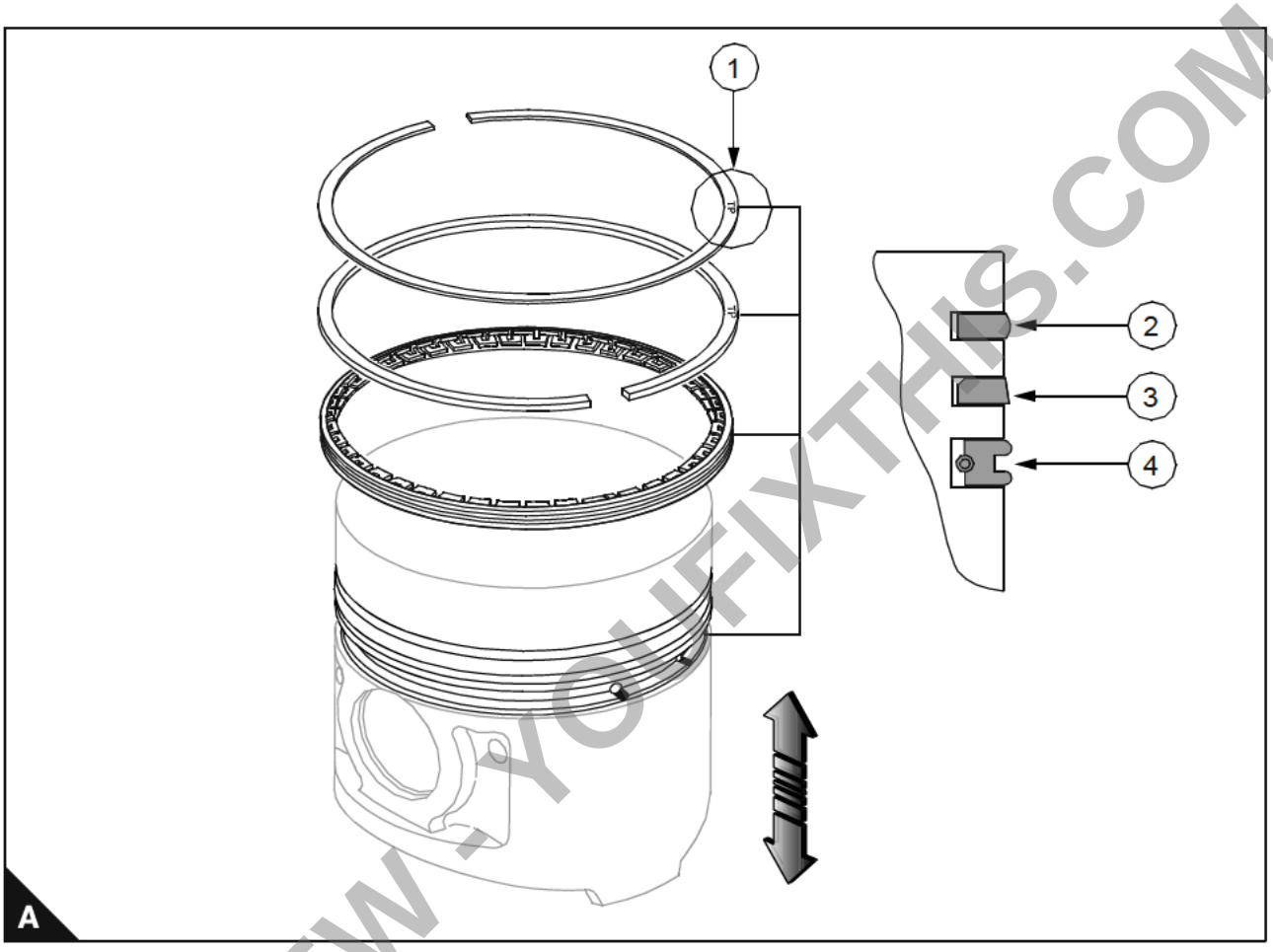
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Piston and piston ring

To inspect **Operation 4-4**

Any letters or marks on a surface of a ring (A1) will always be to the upper face.

The piston profile shows the No.1 ring (A2), No.2 ring (A3) and the oil scraper ring (A4).



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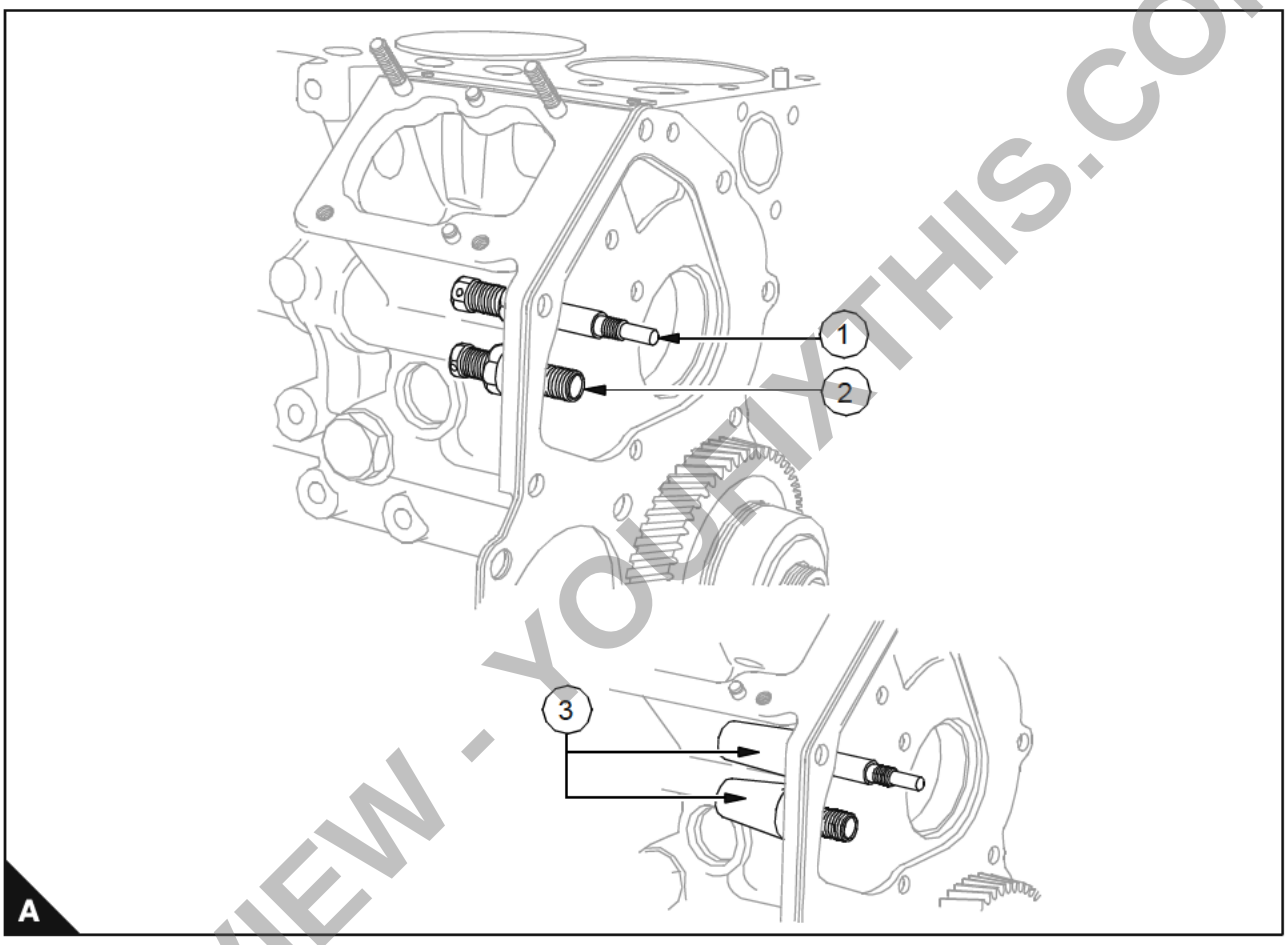
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Max fuel screw and max speed screw

To locate **Operation 6-8**

Notes:

- The max fuel screw (A1) and max speed screw (A2) should not be adjusted by the operator.
- An anti tamper device (A3) may be fitted. Where this device is present, see Operation 6-9.
- If adjustment of the maximum fuel screw or the no load speed is necessary, the adjustment must be done on an engine test facility by personnel approved by Perkins Engines Company Ltd.



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Lubrication system

Oil filter canister

To remove and to fit **Operation 10-1**

1 Remove the filter canister with a strap wrench or a similar tool and then discard the canister.

2 Clean the seal face of the filter head.

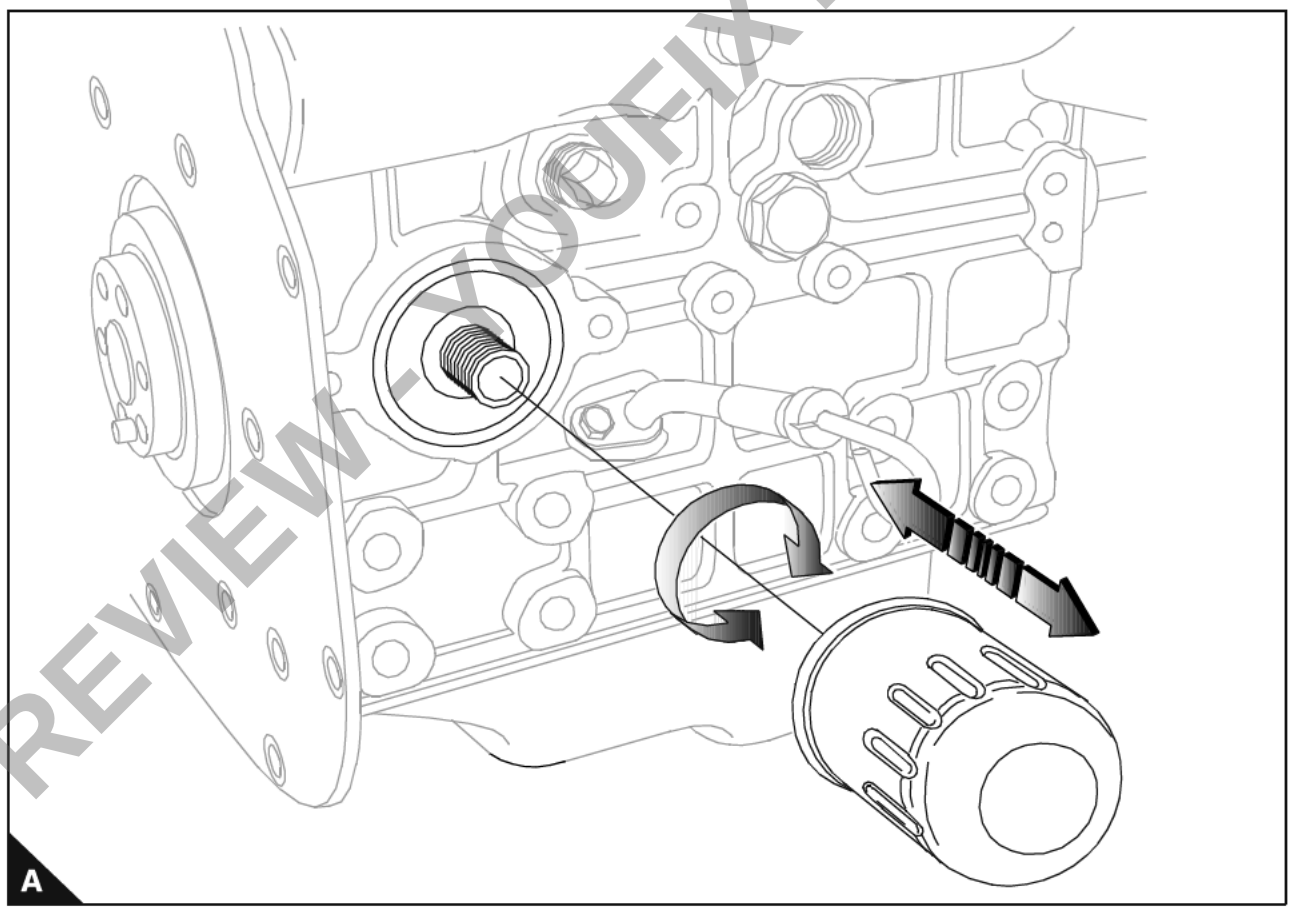
3 Lubricate the seal of the new canister with clean engine oil before assembly.

4 Install the new canister and tighten it by hand only. Do not use a strap wrench.

5 Tighten the canister by a further ½ to ¾ of a turn by hand only.

6 After the lubricating oil has been added to the sump, operate the engine and check for leakage from the filter. When the engine has cooled, check the oil level on the dipstick and add oil to the sump, as necessary.

Caution: *Do not use a strap wrench to tighten the filter canister.*



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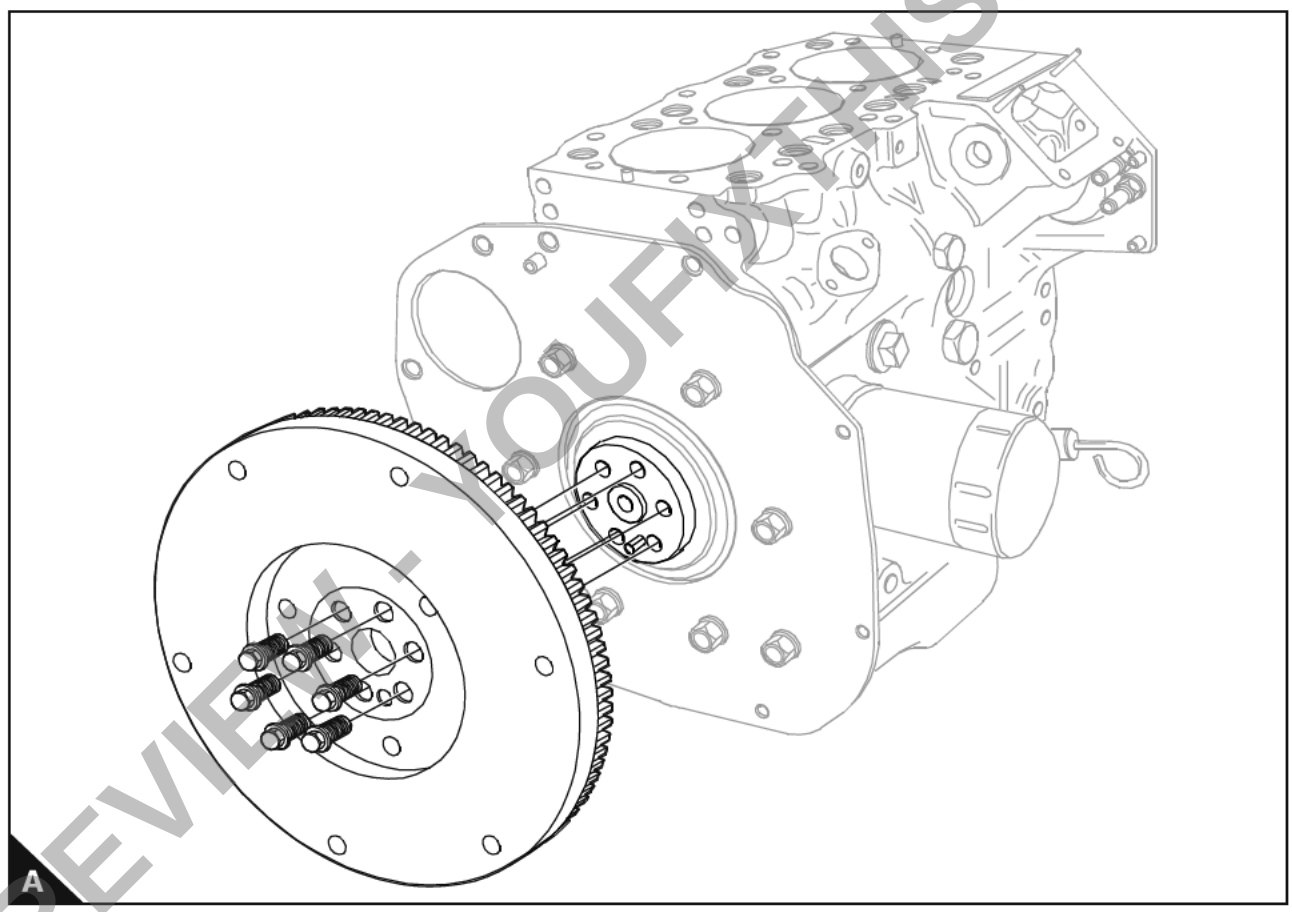
Flywheel and housing

Flywheel

To remove and to fit **Operation 13-1**

Special requirements

Torque Nm (lbf ft) kgf m	
Flywheel setscrews	73 (54) 7,4



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