

Product: Isuzu Industrial Diesel Engine A-4JG1 Workshop Service Repair Manual  
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# INDUSTRIAL DIESEL ENGINE

## A-4JG1 MODEL

# WORKSHOP MANUAL

# ISUZU MOTORS LIMITED

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## **FOREWORD**

This Workshop Manual is designed to help you perform necessary maintenance, service, and repair procedures on applicable Isuzu industrial engines.

Information contained in this Workshop Manual is the latest available at the time of publication.

Isuzu reserves the right to make changes at any time without prior notice.

This Workshop Manual is applicable to 1999 and later models.

## **NOTICE**

Before using this Workshop Manual to assist you in performing engine service and maintenance operations, it is recommended that you carefully read and thoroughly understand the information contained in Section - 1 under the headings "General Repair Instruction" and "Notes on The Format of This Manual"

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**SECTION 1**

**GENERAL INFORMATION**

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### GENERAL REPAIR INSTRUCTIONS

1. Before performing any service operation with the engine mounted, disconnect the grounding cable from the battery.  
This will reduce the chance of cable damage and burning due to short circuiting.
2. Always use the proper tool or tools for the job at hand.  
Where specified, use the specially designed tool or tools.
3. Use genuine ISUZU parts.
4. Never reuse cotter pins, gaskets, O-rings, lock washers, and self locking nuts. Discard them as you remove them. Replace them with new ones.
5. Always keep disassembled parts neatly in groups. This will ensure a smooth reassembly operation.  
It is especially important to keep fastening parts separate. These parts vary in hardness and design, depending on their installation position.
6. All parts should be carefully cleaned before inspection or reassembly.  
Oil ports and other openings should be cleaned with compressed air to make sure that they are completely free of obstructions.
7. Rotating and sliding part surfaces should be lubricated with oil or grease before reassembly.
8. If necessary, use a sealer on gaskets to prevent leakage.
9. Nut and bolt torque specifications should be carefully followed.
10. Always release the air pressure from any machine-mounted air tank(s) before dismounting the engine or disconnecting pipes and hoses. To not do so is extremely dangerous.
11. Always check and recheck your work. No service operation is complete until you have done this.

### NOTES ON THE FORMAT OF THIS MANUAL

This Workshop Manual is applicable to ISUZU industrial engine or engines which is or are stated in the title.

When more than two engine models are dealt in the manual, such engines have common parts and components as well as data and specifications, unless otherwise specified.

1. Find the applicable section by referring to the Table of Contents at the beginning of the Manual.
2. Common technical data such as general maintenance items, service specifications, and tightening torques are included in the "General Information" section.  
The section ENGINE ASSEMBLY is an exception. This parts are divided in three sections to facilitates indexing.
3. Each section is divided into sub-sections dealing with disassembly, inspection and repair, and reassembly.

4. When the same servicing operation is applicable to several different units, the manual will direct you to the appropriate page.
5. For the sake of brevity, self-explanatory removal and installation procedures are omitted. More complex procedures are covered in detail.
6. Each service operation section in this Workshop Manual begins with an exploded view of the applicable area. A brief explanation of the notation used follows.

The diagram shows an exploded view of an inverted engine. The main engine block is at the bottom, labeled 'Inverted Engine'. Above it are various components numbered 1 through 17. Some parts are marked with an asterisk (\*), some are enclosed in a square frame, and some have a triangle symbol (▲) next to their number. A legend at the bottom left lists the parts and their symbols. A legend on the right explains the symbols and their meanings.

**Disassembly Steps - 2**

1. Water by-pass hose	10. Cylinder head gasket
2. Thermostat housing	▲ 11. Crankshaft damper pulley with dust seal
3. Water pump	12. Timing gear case cover
▲ 4. Injection nozzle holder	13. Timing gear cover
5. Glow plug and glow plug connector	14. Timing gear oil pipe
6. Cylinder head cover	15. Idler gear "B" and shaft
▲ 7. Rocker arm shaft and rocker arm	16. Idler gear "A"
8. Push rod	▲ 17. Idler gear shaft
▲ 9. Cylinder head	

★ Repair kit

Inverted Engine

● Parts marked with an asterisk (\*) are included in the repair kit.

● Parts within a square frame are to be removed and installed as a single unit, and their disassembly steps or reassembly steps are shown in the illustrations respectively.

● The number tells you the service operation sequence.

● Removal of unnumbered parts is unnecessary unless replacement is required.

● The "\* Repair Kit" indicates that a repair kit is available.

● The parts listed under "Disassembly Steps" or "Reassembly Steps" are in the service operation sequence.

● The removal or installation of parts marked with a triangle (▲) is an important operation. Detailed information is given in the text.

**GENERAL INFORMATION**

7. Below is a sample of the text of the Workshop Manual.

**4. Camshaft Timing Gear**

- 1) Install the thrust plate ①.
- 2) Apply engine oil to the bolt threads ②.
- 3) Install the camshaft timing gear with the timing mark stamped side facing out.

Camshaft Timing Gear Bolt Torque      kgf·m(lb.ft/N·m)

11.0 ± 1.0 (79.5 ± 7.2/107.8 ± 9.8)	
-------------------------------------	--

**13. Crankshaft Rear Oil Seal**

- 1) Apply engine oil to the oil seal lip circumference and the oil seal outer circumference.
- 2) Use the oil seal installer to install the oil seal to the cylinder body.

Oil Seal Installer: 5-8840-0141-0

**14. Flywheel Housing**

- 1) Apply liquid gasket to the shaded area shown in the illustration.
- 2) Tighten the flywheel housing bolts to the specified torque a little at a time in the sequence shown in the illustration.

Flywheel Housing Bolt Torque      kgf·m(lb.ft/N·m)

M10x1.25 (0.40x0.05) Bolt	5.6±1.0 (40.5±7.2/ 54.9±9.8)
M12x1.25 (0.47x0.05) Bolt	10.5±1.0 (76.0±7.2/103.0±9.8)
M12x1.75 (0.47x0.07) Bolt	9.8±1.0 (71.0±7.2/ 96.0±9.8)

This is the item shown in the illustration. It is marked with a triangle (▲) on the Major Components page.

Letters and numbers contained in a circle refer to the illustration.

Special tools are identified by the tool name and/or number. The illustration shows how the special tool is to be used.

Symbols indicate the type of service operation or step to be performed. A detailed explanation of these symbols follows.

Service data and specifications are given in this table.

8. The following symbols appear throughout this Workshop Manual. They tell you the type of service operation or step to perform.

- |  |                             |  |  |
|--|-----------------------------|--|--|
|  | .... Removal                |  | .... Adjustment  |
|  | .... Installation           |  | .... Cleaning  |
|  | .... Disassembly            |  | .... Important operation requiring extra care                      |
|  | .... Reassembly             |  | .... Specified torque (tighten)                                    |
|  | .... Alignment (marks)      |  | .... Special tool use required or recommended(Isuzu tool or tools) |
|  | .... Directional indication |  | .... Commercially available tool use required or recommended       |
|  | .... Inspection             |  | .... Lubrication (oil)   |
|  | .... Measurement            |  | .... Lubrication (grease)  |
|  |                             |  | .... Sealant application   |

9. Measurement criteria are defined by the terms "standard" and "limit".

A measurement falling within the "standard" range indicates that the applicable part or parts are serviceable.

"Limit" should be thought of as an absolute value.

A measurement which is outside the "limit" indicates that the applicable part or parts must be either repaired or replaced.

10. Components and parts are listed in the singular form throughout the Manual.

11. Directions used in this Manual are as follows:

Front

The cooling fan side of the engine viewed from the flywheel.

Right

The right hand side viewed from the same position.

Left

The left hand side viewed from the same position.

Rear

The flywheel side of the engine.

Cylinder numbers are counted from the front of the engine.

The front most cylinder is No. 1 and rear most cylinder is the final cylinder number of the engine.

The engine's direction of rotation is counterclockwise viewed from the flywheel.

MAIN DATA AND SPECIFICATIONS

Engine Model		
Item	A-4JG1	
Engine type	Water cooled, four-cycle, in-line, overhead valve	
Combustion chamber type	Direct injection	
Cylinder liner type	Dry	
No. of cylinders - Bore x Stroke	mm(in.)	4 - 95.4 x 107
Total piston displacement	lit(cid)	3.059 (186.7)
Compression ratio (To 1)		18.6
*Engine dimensions	mm(in.)	739 x 625 x 746
Length x Width x Height		(29.1 x 24.6 x 29.4)
*Engine weight (Dry)	kg(lb.)	248 (547)
Fuel injection order		1 - 3- 4 - 2
*Fuel injection timing (B.T.D.C.)	degrees	16
Specified fuel		Diesel fuel
Injection pump		In-line plunger, Bosch A type
Governor		Variable speed mechanical type
*Low idle speed	min <sup>-1</sup>	850 - 1,000
Injection nozzle		Multi-hole type
Injection starting pressure	MPa(kgf/cm <sup>2</sup> /psi)	18.1 (185/2630)
Fuel filter type		Cartridge paper element
Water sedimentor (if so equipped)		Sediment/water level indicating type
Compression pressure	MPa(kgf/cm <sup>2</sup> /psi)	3.04 (31/441)
Valve clearance (at cold)	Intake mm(in.)	0.40 (0.0157)
	Exhaust mm(in.)	0.40 (0.0157)
Lubrication method		Pressurized circulation
Oil pump		Trochoid type
Main oil filter type		Cartridge paper element, full flow
Partial oil filter		Not equipped
*Lubricating oil volume	lit.(qts)	7.6 - 9.6 (8.0 - 10.1) (Oil pan)
Oil cooler (if so equipped)		Water cooled built in oil filter
Cooling method		Pressurized forced circulation
Coolant volume	lit.(qts)	5.0 (5.3)
Water pump		Belt driven, impeller type
Thermostat type		Wax pellet type
*Alternator	V-A	12 - 50
*Starter	V-kW	12 - 2.2

Specifications marked with an asterisk (\*) will vary according to engine application.

## TIGHTENING TORQUE SPECIFICATIONS

The tightening torque values given in the table below are applicable to the bolts unless otherwise specified.

### STANDARD BOLT

N·m (kgf·m)

Bolt Identification				
				
<b>M 6 × 1.0</b>	3.9 ~ 7.8 { 0.4 ~ 0.8 }	4.9 ~ 9.8 { 0.5 ~ 1.0 }		
<b>M 8 × 1.25</b>	7.8 ~ 17.7 { 0.8 ~ 1.8 }	11.8 ~ 22.6 { 1.2 ~ 2.3 }	16.7 ~ 30.4 { 1.7 ~ 3.1 }	
<b>M10 × 1.25</b>	20.6 ~ 34.3 { 2.1 ~ 3.5 }	27.5 ~ 46.1 { 2.8 ~ 4.7 }	37.3 ~ 62.8 { 3.8 ~ 6.4 }	
* <b>M10 × 1.5</b>	19.6 ~ 33.4 { 2.0 ~ 3.4 }	27.5 ~ 45.1 { 2.8 ~ 4.6 }	36.3 ~ 59.8 { 3.7 ~ 6.1 }	
<b>M12 × 1.25</b>	49.1 ~ 73.6 { 5.0 ~ 7.5 }	60.8 ~ 91.2 { 6.2 ~ 9.3 }	75.5 ~ 114.0 { 7.7 ~ 11.6 }	
* <b>M12 × 1.75</b>	45.1 ~ 68.7 { 4.6 ~ 7.0 }	56.9 ~ 84.4 { 5.8 ~ 8.6 }	71.6 ~ 107.0 { 7.3 ~ 10.9 }	
<b>M14 × 1.5</b>	76.5 ~ 115.0 { 7.8 ~ 11.7 }	93.2 ~ 139.0 { 9.5 ~ 14.2 }	114.0 ~ 171.0 { 11.6 ~ 17.4 }	
* <b>M14 × 2.0</b>	71.6 ~ 107.0 { 7.3 ~ 10.9 }	88.3 ~ 131.0 { 9.0 ~ 13.4 }	107.0 ~ 160.0 { 10.9 ~ 16.3 }	
<b>M16 × 1.5</b>	104.0 ~ 157.0 { 10.6 ~ 16.0 }	135.0 ~ 204.0 { 13.8 ~ 20.8 }	160.0 ~ 240.0 { 16.3 ~ 24.5 }	
* <b>M16 × 2.0</b>	100.0 ~ 149.0 { 10.2 ~ 15.2 }	129.0 ~ 194.0 { 13.2 ~ 19.8 }	153.0 ~ 230.0 { 15.6 ~ 23.4 }	
<b>M18 × 1.5</b>	151.0 ~ 226.0 { 15.4 ~ 23.0 }	195.0 ~ 293.0 { 19.9 ~ 29.9 }	230.0 ~ 345.0 { 23.4 ~ 35.2 }	
* <b>M18 × 2.5</b>	151.0 ~ 226.0 { 15.4 ~ 23.0 }	196.0 ~ 294.0 { 20.0 ~ 30.0 }	231.0 ~ 346.0 { 23.6 ~ 35.3 }	
<b>M20 × 1.5</b>	206.0 ~ 310.0 { 21.0 ~ 31.6 }	270.0 ~ 405.0 { 27.5 ~ 41.3 }	317.0 ~ 476.0 { 32.3 ~ 48.5 }	
* <b>M20 × 2.5</b>	190.0 ~ 286.0 { 19.4 ~ 29.2 }	249.0 ~ 375.0 { 25.4 ~ 38.2 }	293.0 ~ 440.0 { 29.9 ~ 44.9 }	
<b>M22 × 1.5</b>	251.0 ~ 414.0 { 25.6 ~ 42.2 }	363.0 ~ 544.0 { 37.0 ~ 55.5 }	425.0 ~ 637.0 { 43.3 ~ 64.9 }	
* <b>M22 × 2.5</b>	218.0 ~ 328.0 { 22.2 ~ 33.4 }	338.0 ~ 507.0 { 34.5 ~ 51.7 }	394.0 ~ 592.0 { 40.2 ~ 60.4 }	
<b>M24 × 2.0</b>	359.0 ~ 540.0 { 36.6 ~ 55.0 }	431.0 ~ 711.0 { 43.9 ~ 72.5 }	554.0 ~ 831.0 { 56.5 ~ 84.7 }	
* <b>M24 × 3.0</b>	338.0 ~ 507.0 { 34.5 ~ 51.7 }	406.0 ~ 608.0 { 41.4 ~ 62.0 }	521.0 ~ 782.0 { 53.1 ~ 79.7 }	

An asterisk (\*) indicates that the bolts are used for female threaded parts that are made of soft materials such as casting.

**GENERAL INFORMATION**

**TIGHTENING TORQUE SPECIFICATIONS**

The tightening torque values given in the table below are applicable to the bolts unless otherwise specified.

**FLANGED HEAD BOLT**

N·m (kgf·m)

Bolt Identification  Bolt Diameter × pitch (mm)			
<b>M 6 × 1.0</b>	4.6 ~ 8.5 { 0.5 ~ 0.9 }	6.6 ~ 12.2 { 0.6 ~ 1.2 }	—————
<b>M 8 × 1.25</b>	10.5 ~ 19.6 { 1.1 ~ 2.0 }	15.3 ~ 28.4 { 1.6 ~ 2.9 }	18.1 ~ 33.6 { 2.1 ~ 3.4 }
<b>M10 × 1.25</b>	23.1 ~ 38.5 { 2.4 ~ 3.9 }	35.4 ~ 58.9 { 3.6 ~ 6.1 }	42.3 ~ 70.5 { 4.3 ~ 7.2 }
* <b>M10 × 1.5</b>	22.3 ~ 37.2 { 2.3 ~ 3.8 }	34.5 ~ 57.5 { 3.5 ~ 5.8 }	40.1 ~ 66.9 { 4.1 ~ 6.8 }
<b>M12 × 1.25</b>	54.9 ~ 82.3 { 5.6 ~ 8.4 }	77.7 ~ 117.0 { 7.9 ~ 11.9 }	85.0 ~ 128.0 { 8.7 ~ 13.0 }
* <b>M12 × 1.75</b>	51.0 ~ 76.5 { 5.2 ~ 7.8 }	71.4 ~ 107.0 { 7.3 ~ 10.9 }	79.5 ~ 119.0 { 8.1 ~ 12.2 }
<b>M14 × 1.5</b>	83.0 ~ 125.0 { 8.5 ~ 12.7 }	115.0 ~ 172.0 { 11.7 ~ 17.6 }	123.0 ~ 185.0 { 12.6 ~ 18.9 }
* <b>M14 × 2.0</b>	77.2 ~ 116.0 { 7.9 ~ 11.8 }	108.0 ~ 162.0 { 11.1 ~ 16.6 }	116.0 ~ 173.0 { 11.8 ~ 17.7 }
<b>M16 × 1.5</b>	116.0 ~ 173.0 { 11.8 ~ 17.7 }	171.0 ~ 257.0 { 17.4 ~ 26.2 }	177.0 ~ 265.0 { 18.0 ~ 27.1 }
* <b>M16 × 2.0</b>	109.0 ~ 164.0 { 11.2 ~ 16.7 }	163.0 ~ 244.0 { 16.6 ~ 24.9 }	169.0 ~ 253.0 { 17.2 ~ 25.8 }

A bolt with an asterisk (\*) is used for female screws of soft material such as cast iron.



**SPECIAL PARTS FIXING NUTS AND BOLTS**

**Cylinder Head Cover, Cylinder Head, and Rocker Arm Shaft Bracket**

**N·m (kgf·m/lb.ft)**

8 - 18  
(0.8 - 1.8/5.8 - 13)

49 - 59  
(5.0 - 6.0/36 - 43)

10 - 20  
(1.0 - 2.0/7.2 - 14)

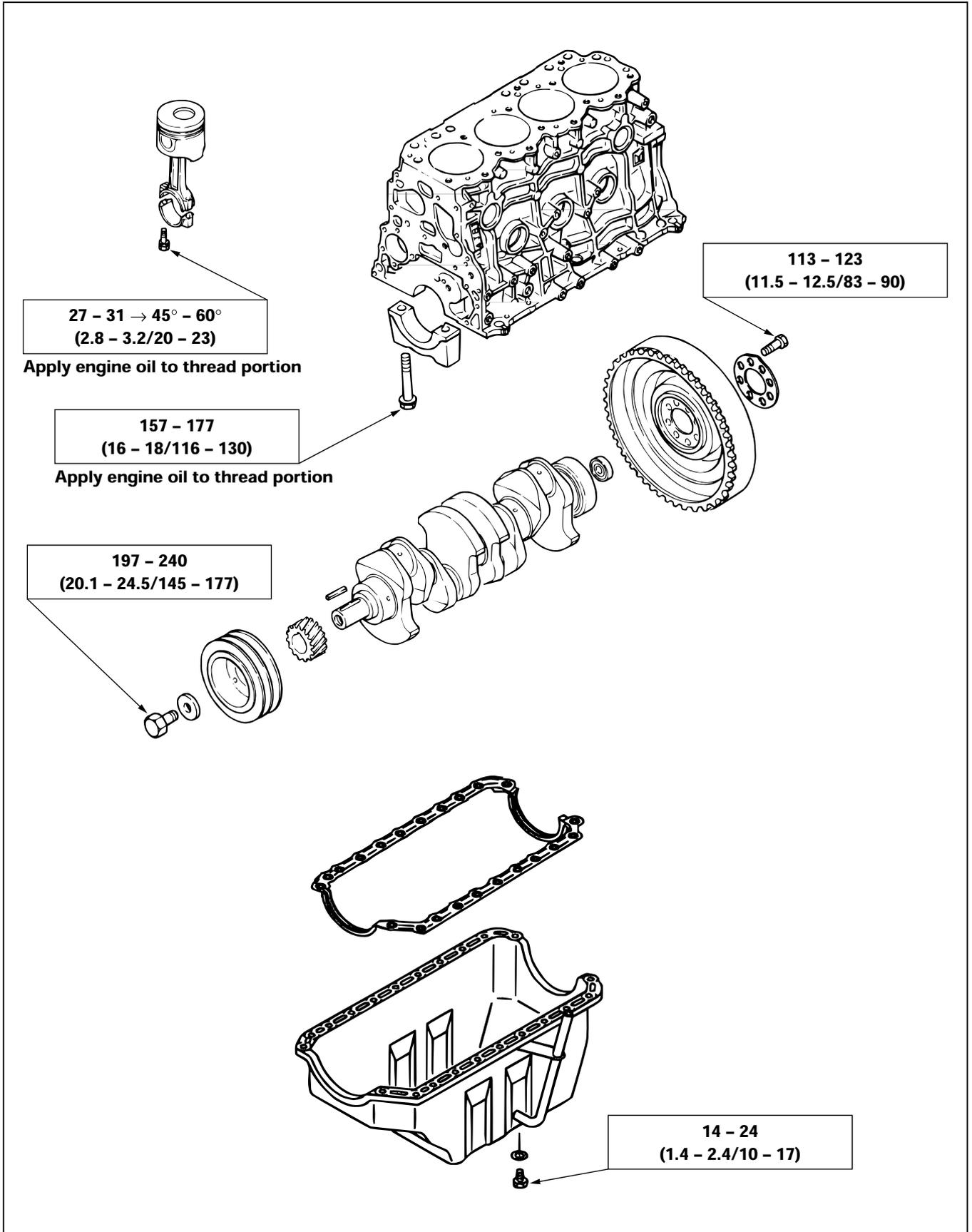
1st Step	2nd Step	3rd Step
44 - 54 (4.5 - 5.5/33 - 40)	60 - 75°	60 - 75°

Apply engine oil to thread portion



Crankshaft Bearing Cap, Connecting Rod Bearing Cap, Crankshaft Damper Pulley, Flywheel, and Oil Pan

N·m (kgf·m/lb.ft)

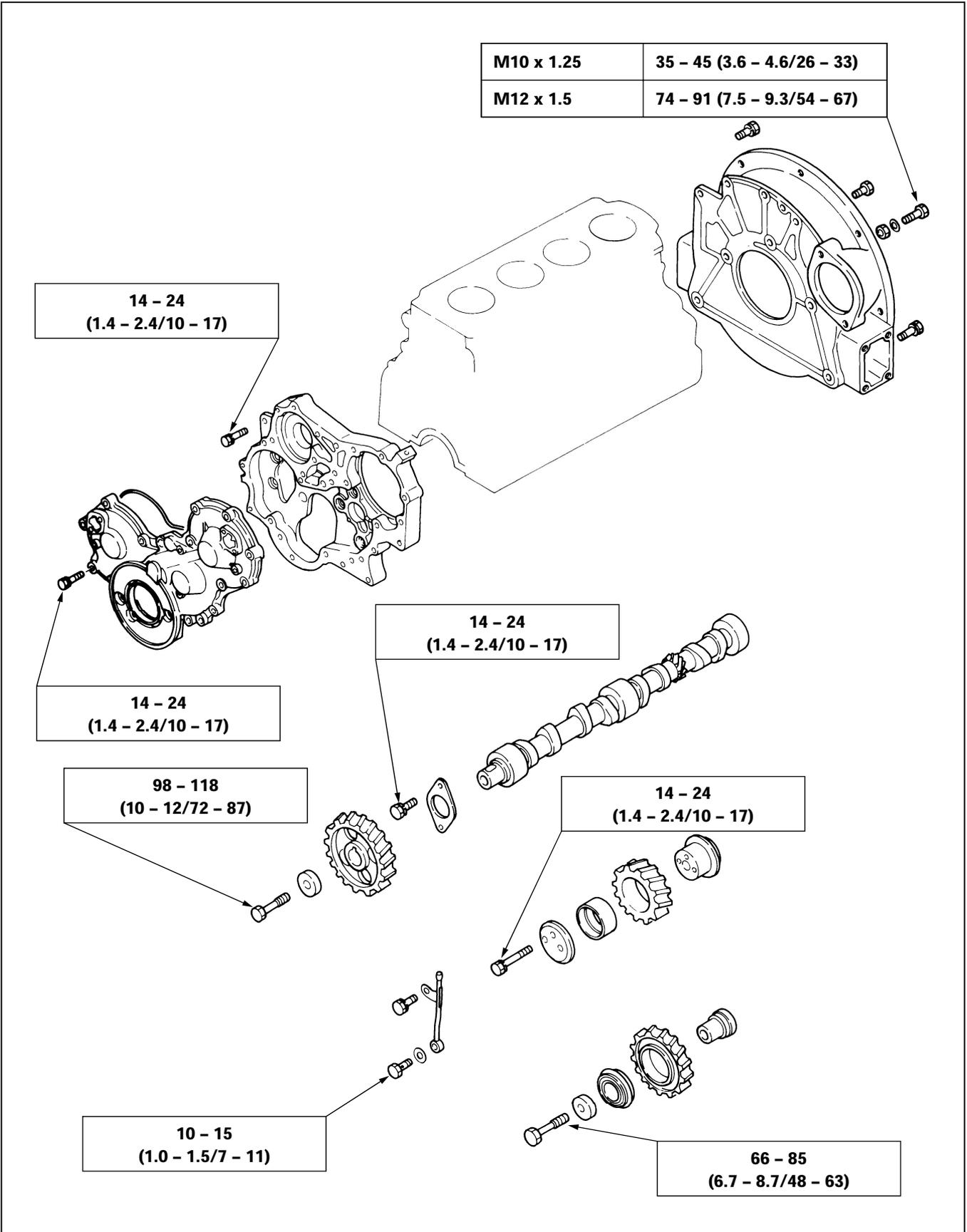




Timing Gear Case, Flywheel Housing, Camshaft, and Timing Gear

N·m (kgf·m/lb.ft)

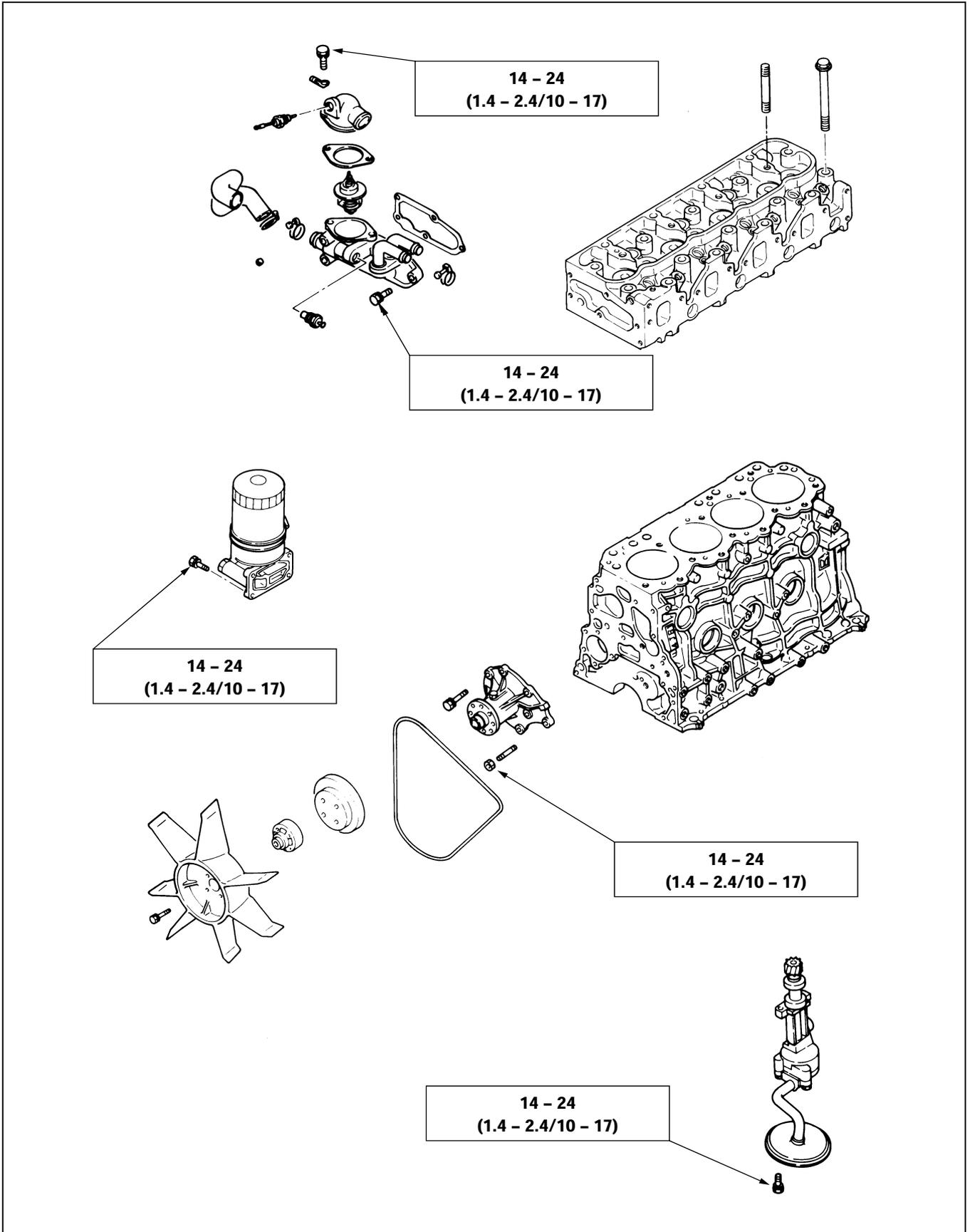
M10 x 1.25	35 - 45 (3.6 - 4.6/26 - 33)
M12 x 1.5	74 - 91 (7.5 - 9.3/54 - 67)





Cooling and Lubricating System

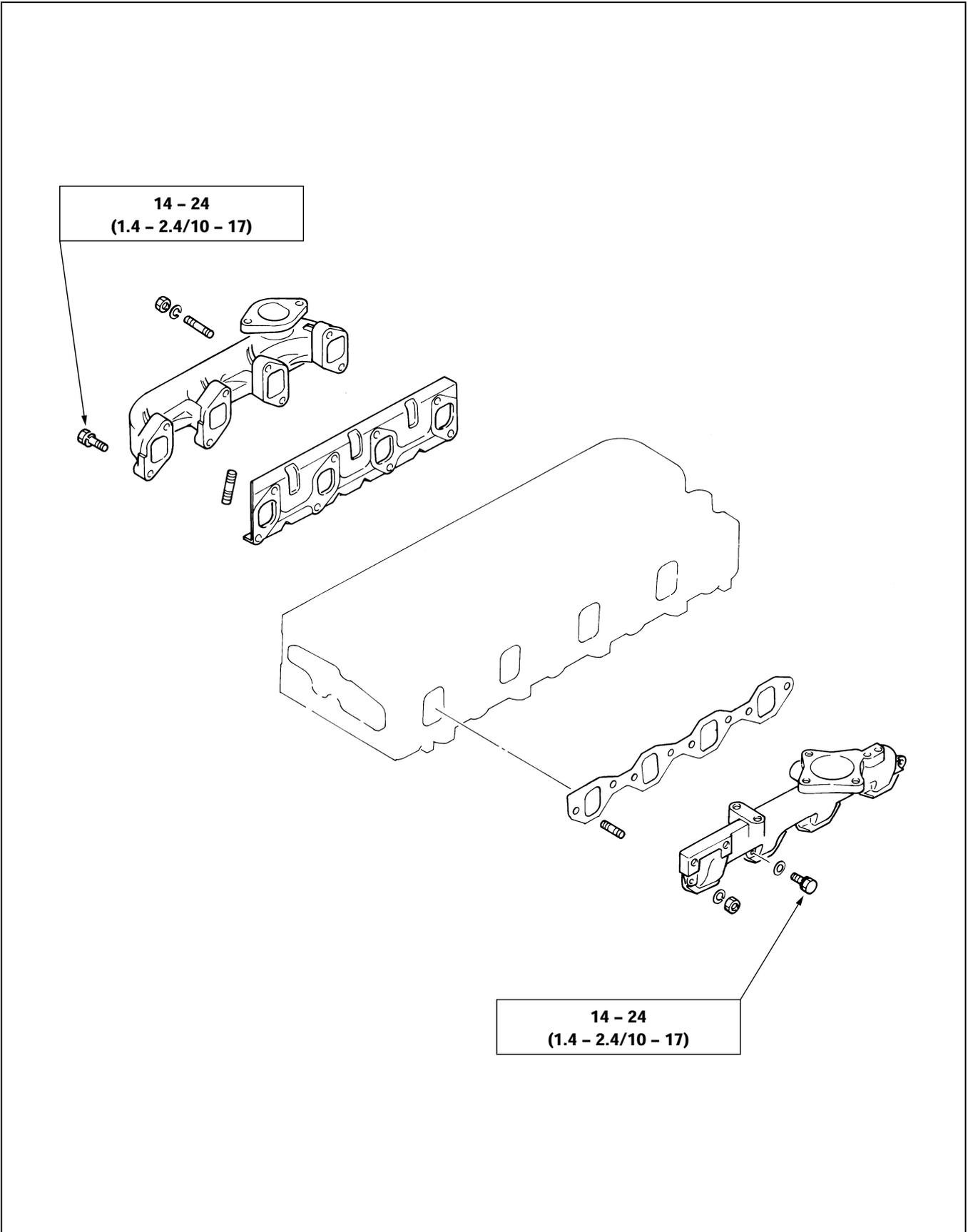
N·m (kgf·m/lb.ft)





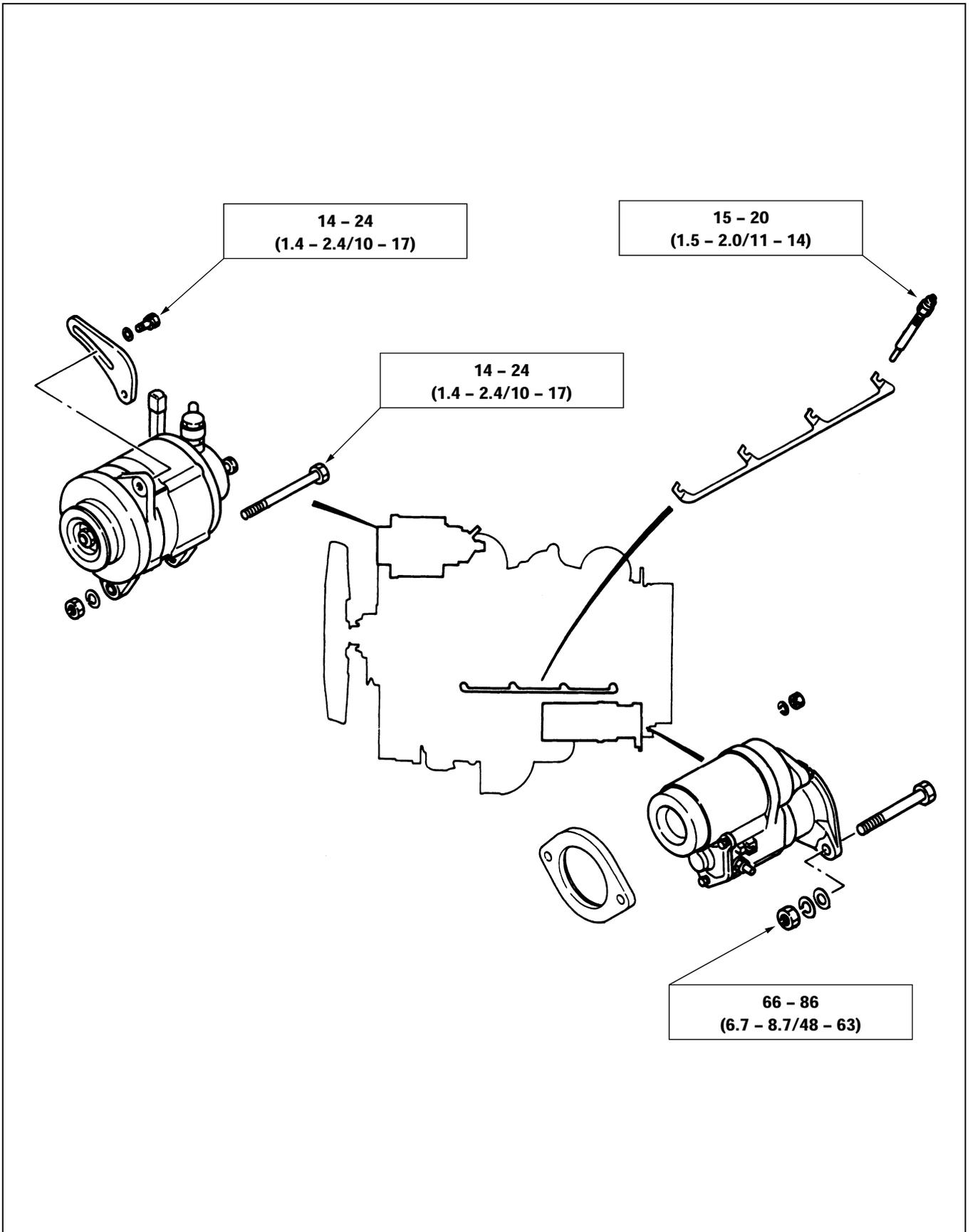
Intake and Exhaust Manifold

N·m (kgf·m/lb.ft)





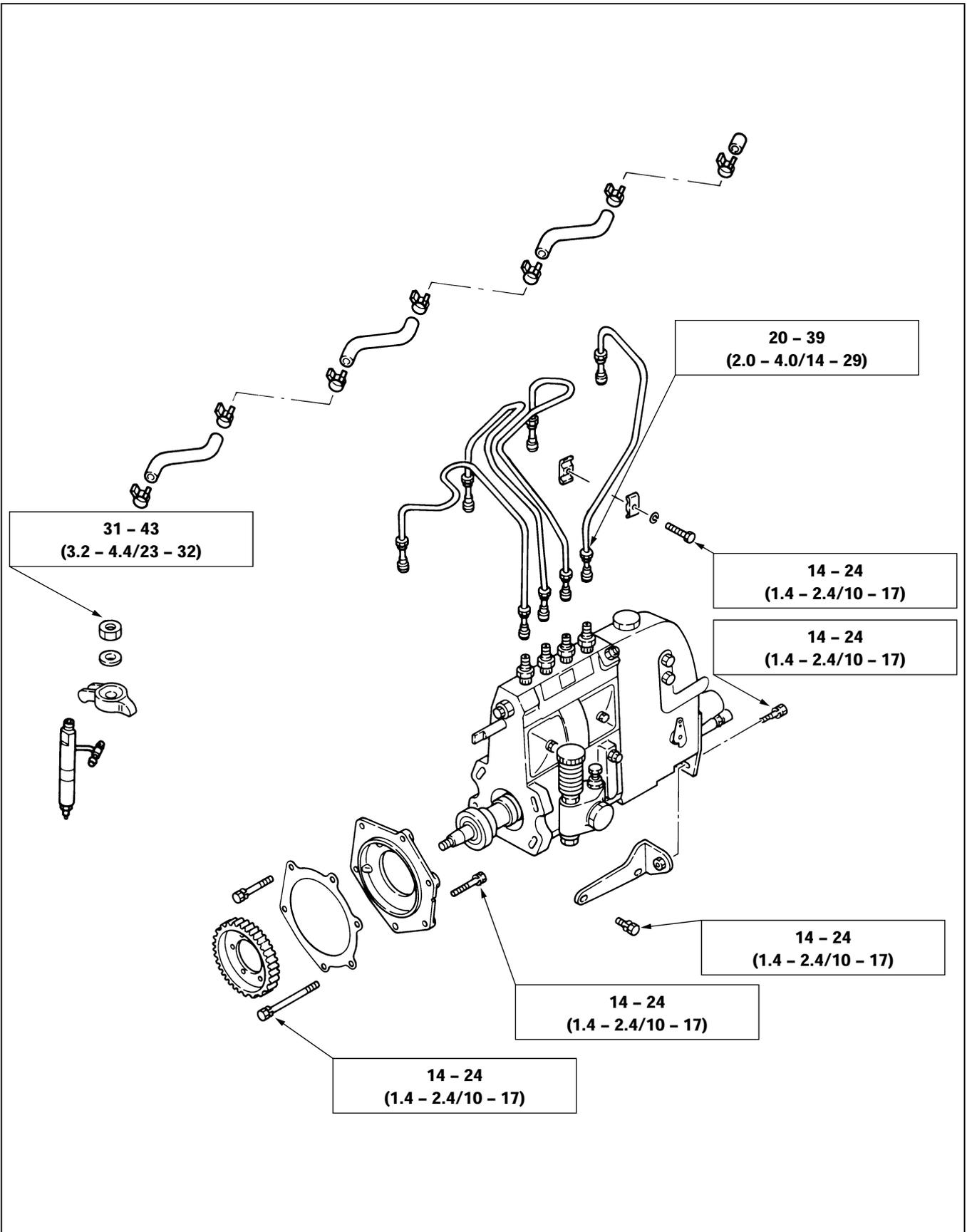
N·m (kgf·m/lb.ft)





Fuel Injection System

N·m (kgf·m/lb.ft)



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# MEMO

A series of horizontal dotted lines for writing.

## SECTION 2

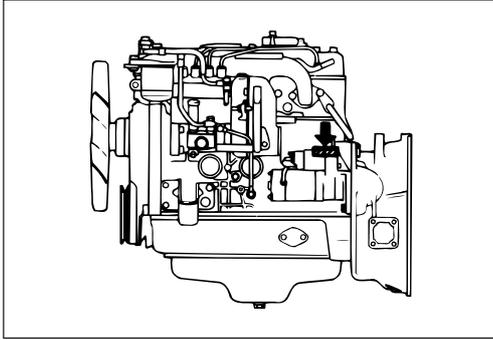
## MAINTENANCE

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## MAINTENANCE

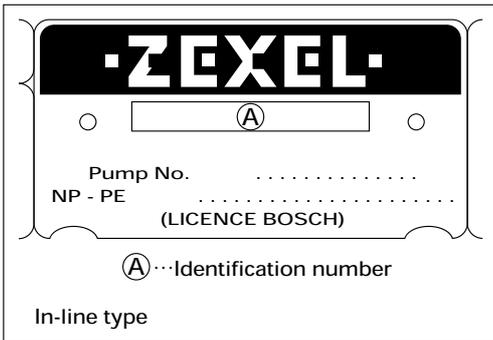
Servicing refers to general maintenance procedures to be performed by qualified service personnel. Maintenance interval such as fuel or oil filter changes should be referred to "INSTRUCTION MANUAL".



### MODEL IDENTIFICATION

#### Engine Serial Number

The engine number is stamped on the rear left hand side of the cylinder body.



### INJECTION PUMP IDENTIFICATION

Injection volume should be adjusted after referring to the adjustment data applicable to the injection pump installed.

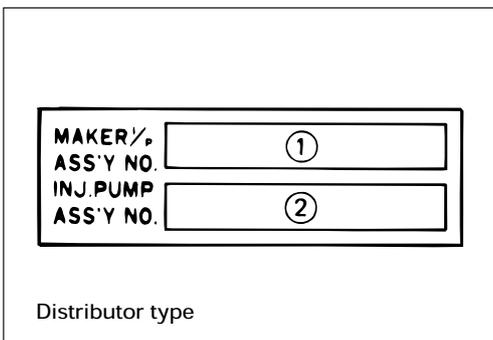
The injection pump identification number (A) is stamped on the injection pump identifications plate.

#### Note:

Always check the identification number before beginning a service operation.

Applicable service data will vary according to the identification number. Use of the wrong service data will result in reduced engine performance and engine damage.

- ① ZEXEL (Manufacturer of the injection pump) identification number
- ② ISUZU Parts Number



### LUBRICATING SYSTEM

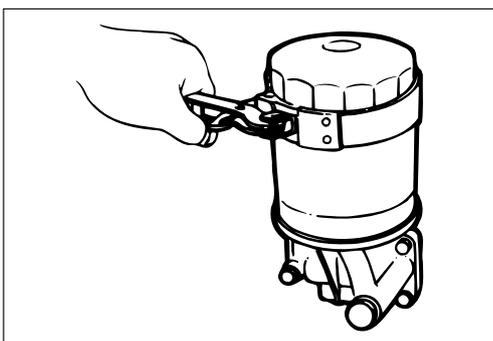
#### Main Oil Filter

#### Replacement Procedure

1. Loosen the drain plug to drain the engine oil.
2. Wait a few minutes and then retighten the drain plug.
3. Loosen the used oil filter by turning it counterclockwise with a filter wrench.



Filter Wrench





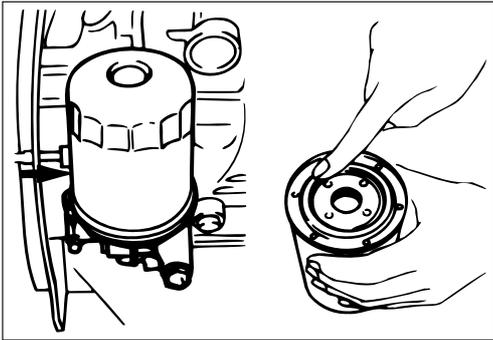
- Clean the oil cooler fitting face.

This will allow the new oil filter to seat properly.



- Apply a light coat of engine oil to the O-ring.

- Turn in the new oil filter until the filter O-ring is fitted against the sealing face.



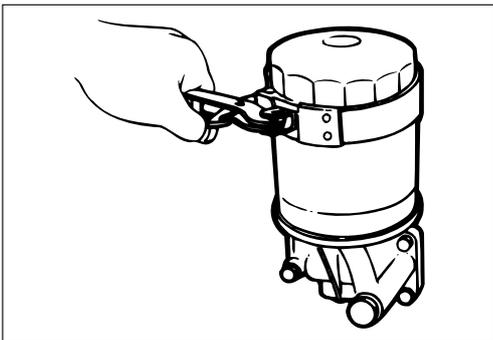
- Use a filter wrench to turn in the filter an additional 1 and 1/4 of a turn.

Filter Wrench

- Check the engine oil level and replenish to the specified level if required.



- Start the engine and check for oil leakage from the main oil filter.



## FUEL SYSTEM

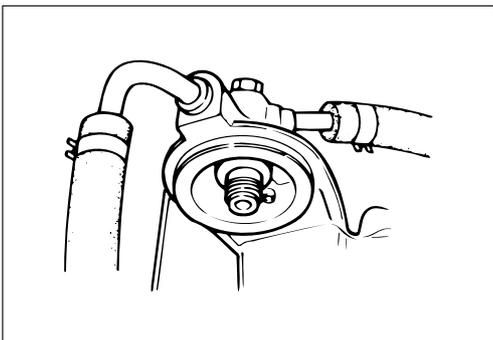
### Fuel Filter

#### Replacement Procedure



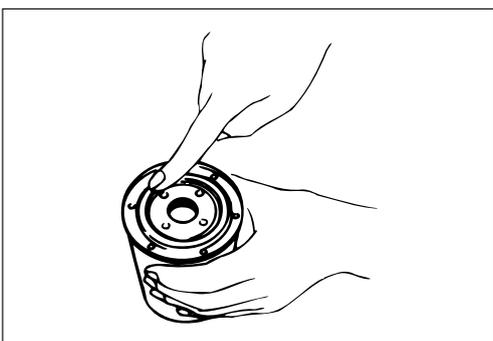
- Loosen the used fuel filter by turning it counter-clockwise with the filter wrench.

Filter Wrench



- Clean the upper cover fitting face.

This will allow the new fuel filter to seat properly.



- Apply a light coat of engine oil to the O-ring.

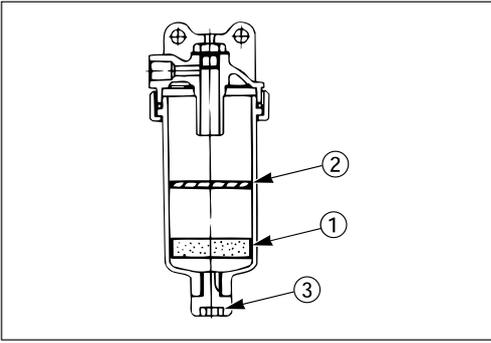
- Supply fuel to the new fuel filter to facilitate bleeding.

- Turn in the new fuel filter until the filter O-ring is fitted against the sealing face.

Be very careful to avoid fuel spillage.



- Use a filter wrench to turn in the fuel filter an additional 1/3 to 2/3 of a turn.



**Water Separator (Water Sedimentor)  
(Optional Equipment)**

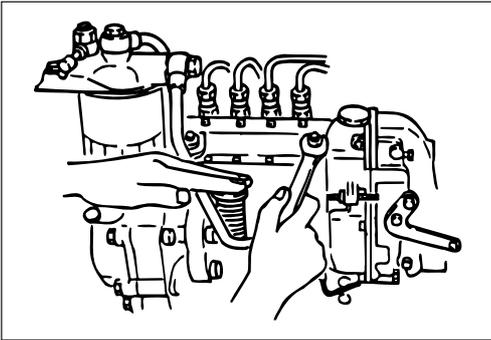
Check the water separator float ① level.  
If the float ① has reached level ② , loosen the drain plug ③ (at the bottom side of the water separator) to drain the water.



Drain Plug Torque

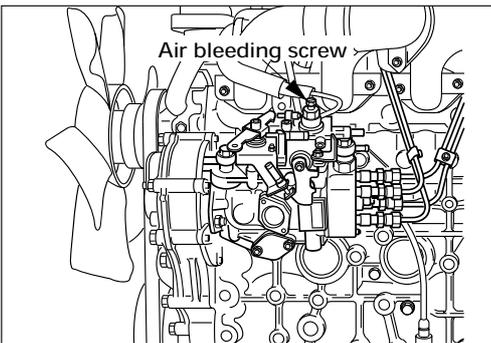
N·m (kgf·m/lb.ft)

9 – 15 (0.9 – 1.5/7 – 11)
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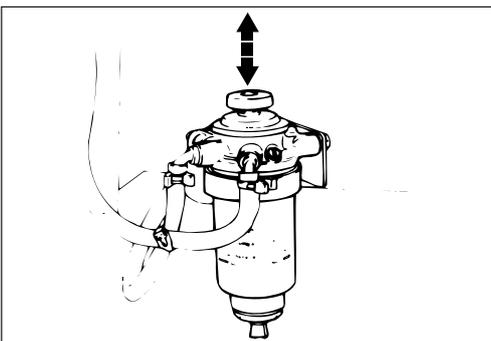


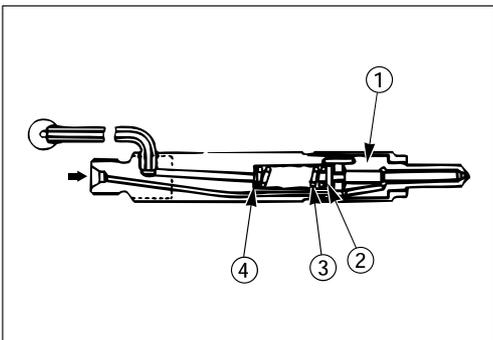
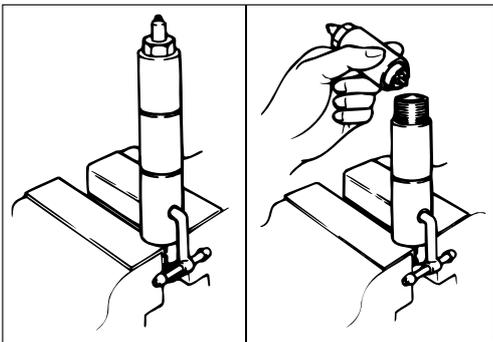
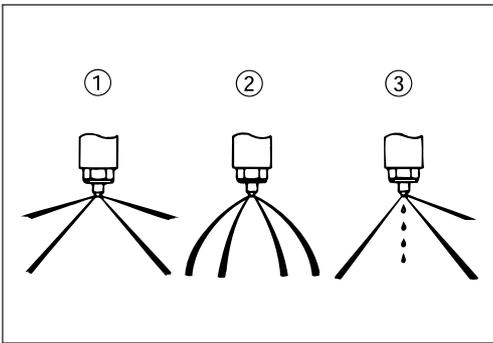
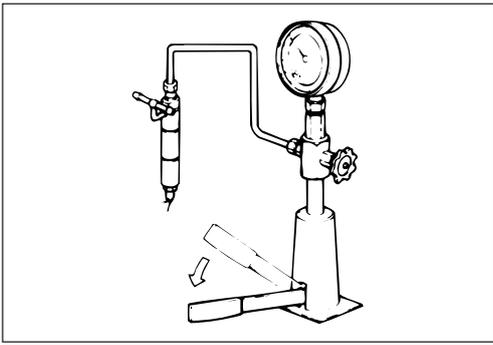
**Air Bleeding**

1. For the engine equipped with in-line type injection pump
  - 1) Loosen the priming pump cap ① on the injection pump.
  - 2) Loosen the fuel return eye bolt ② on the fuel filter.
  - 3) Operate the priming pump until there are no more bubbles visible in the fuel being discharged from the fuel return eye bolt on the fuel filter.
  - 4) Retighten the fuel return eye bolt on the fuel filter.
  - 5) Loosen the bleeder bolt ③ while operating the injection pump priming pump to check that the air has been bled completely.
  - 6) Operate the priming pump several times to check for fuel leakage around the injection pump and the fuel filter.



2. For the engine equipped with distributor type injection pump
  - 1) Loosen the bleeder screw on the injection pump overflow valve.
  - 2) Operate the priming pump until fuel mixed with foam flows from the bleeder screw.
  - 3) Tighten the bleeder screw.
  - 4) Operate the priming pump several times and check for fuel leakage.





**Injection Nozzle**

**Injection Nozzle Inspection**

Use a nozzle tester to check the injection nozzle opening pressure and the spray condition.

If the opening pressure is above or below the specified value, the injection nozzle must be replaced or reconditioned.

If the spray condition is bad, the injection nozzle must be replaced or reconditioned.

Injection Nozzle Opening Pressure	MPa (kgf/cm <sup>2</sup> /psi)
18.1 (185/2,630)	

**Spray Condition**

- (1) Correct
- (2) Incorrect (Restrictions in orifice)
- (3) Incorrect (Dripping)

**Injection Nozzle Adjustment**



1. Clamp the injection nozzle in a vise.
2. Use a wrench to remove the injection nozzle retaining nut.
3. Install the injection nozzle ①, the push rod ②, the spring ③, and adjusting shim ④.

Retaining Nut Torque	N-m (kgf-m/lb.ft)
39 – 49 (4.0 – 5.0/29 – 36)	



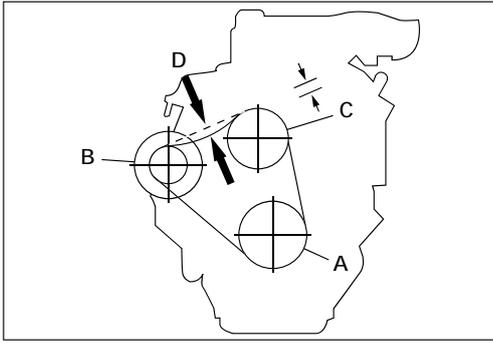
4. Attach the injection nozzle holder to the injection nozzle tester.
5. Apply pressure to the nozzle tester to check that the injection nozzle opens at the specified pressure.

If the injection nozzle does not open at the specified pressure, install or remove the appropriate number of adjusting shims to adjust it.

Adjusting Shim Availability	mm(in.)
Range	0.1 – 0.59 (0.0039 – 0.023)

**WARNING:**

TEST FLUID FROM THE INJECTION NOZZLE TESTER WILL SPRAY OUT UNDER GREAT PRESSURE. IT CAN EASILY PUNCTURE A PERSON'S SKIN. KEEP YOUR HANDS AWAY FROM THE INJECTION NOZZLE TESTER AT ALL TIMES.



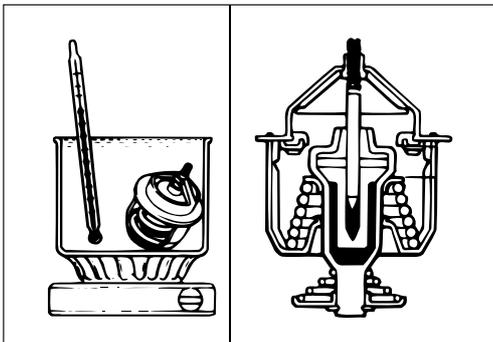
**COOLING SYSTEM**

**Cooling Fan Drive Belt**

Fan belt tension is adjusted by moving the alternator.

- A Crankshaft damper pulley
- B Alternator pulley
- C Cooling fan drive pulley
- D Depress the drive belt mid-portion with a 98 N (10 kgf/22 lb.ft) force.

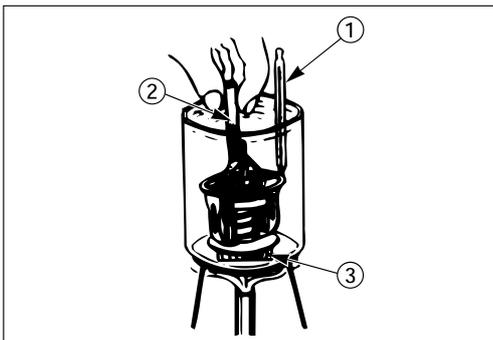
Drive Belt Deflection	mm(in.)
	10.0 (0.39)



**Thermostat**

**Operating Test**

1. Completely submerge the thermostat in water.
2. Heat the water.  
Stir the water constantly to avoid direct heat being applied to the thermostat.



3. Check the thermostat initial opening temperature.

Thermostat Initial Opening Temperature	°C(°F)
	82 (180)



4. Check the thermostat full opening temperature.

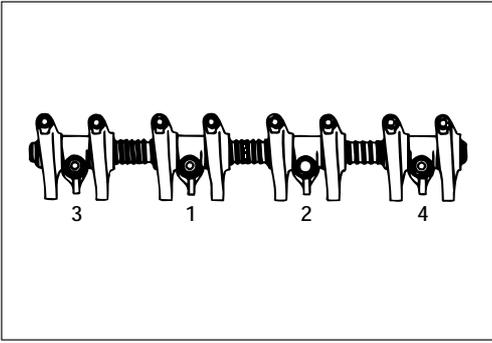
Thermostat Full Opening Temperature	°C(°F)
	95 (203)



Valve Lift at Fully Open Position

	mm(in.)
	8.0 (0.315)

- ① Thermostat
- ② Agitating Rod
- ③ Wooden Piece



## VALVE CLEARANCE ADJUSTMENT



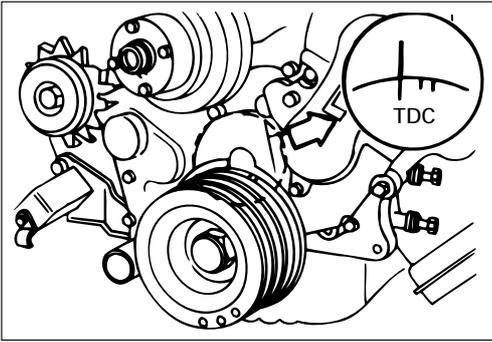
1. Retighten the rocker arm shaft bracket bolts in sequence as shown in the illustration.

Rocker Arm Shaft Bracket Bolt

Torque

N·m (kgf·m/lb.ft)

49 – 59 (5 – 6/36 – 43)
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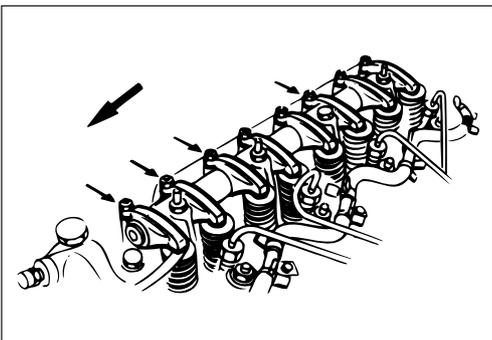


2. Bring the piston in either the No. 1 cylinder or the No. 4 cylinder to TDC on the compression stroke by turning the crankshaft until the crankshaft damper pulley TDC line is aligned with the timing pointer.

3. Check for play in the No. 1 intake and exhaust valve push rods.

If the No. 1 cylinder intake and exhaust valve push rods have play, the No. 1 piston is at TDC on the compression stroke.

If the No. 1 cylinder intake and exhaust valve push rods are depressed, the No. 4 piston is at TDC on the compression stroke.



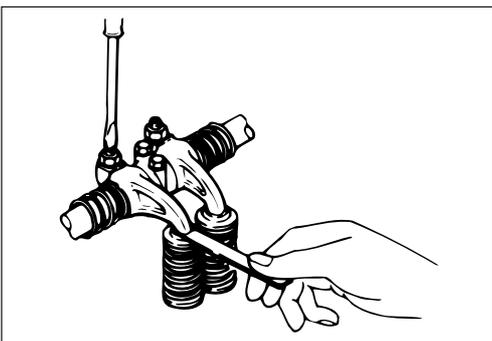
- Adjust the No. 1 or the No. 4 cylinder valve clearances while their respective cylinders are at TDC on the compression stroke.

Valve Clearance

mm(in.)

0.40 (0.016)
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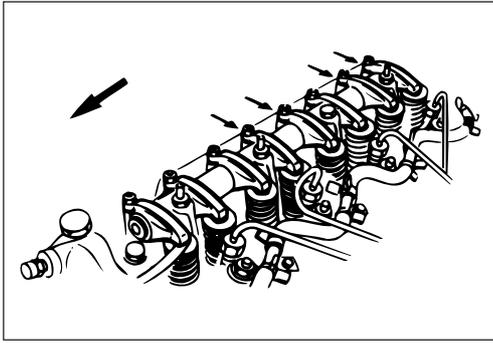
Loosen each valve clearance adjusting screw as shown in the illustration. (At TDC on the compression stroke of the No. 1 cylinder)



- Insert a feeler gauge of the appropriate thickness between the rocker arm and the valve stem end.

4. Turn the valve clearance adjusting screw until a slight drag can be felt on the feeler gauge.

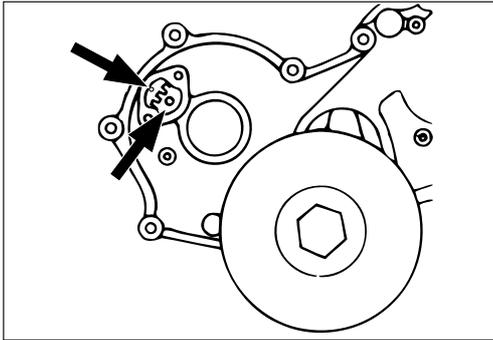
5. Tighten the lock nut securely.



Rotate the crankshaft 360°.

Realign the crankshaft damper pulley TDC line with the timing pointer.

Adjust the clearances for the remaining valves as shown in the illustration. (At TDC on the compression stroke of the No. 4 stroke)



**INJECTION TIMING**

**Injection Timing Confirmation Procedure**



1. In-line type injection pump

1) Rotate the crankshaft clockwise to align the camshaft gear timing mark "O" with the timing gear case cover pointer.

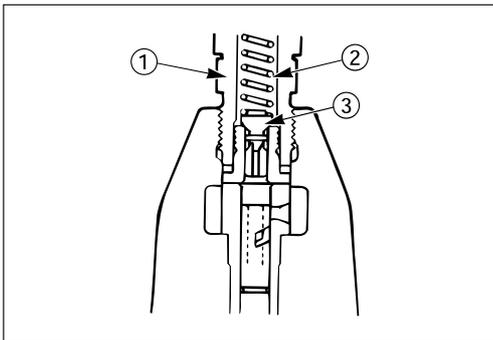
The No. 1 cylinder will now be at the point where nearly injection timing.

2) Remove the No. 1 fuel injection pipe.

3) Remove the delivery valve holder ①, the delivery valve spring ②, and the delivery valve ③.

4) Tighten the delivery valve holder to the specified torque.

Delivery Valve Holder Torque	N·m (kgf·m/lb.ft)
	39 – 44 (4.0 – 4.5/29 – 33)



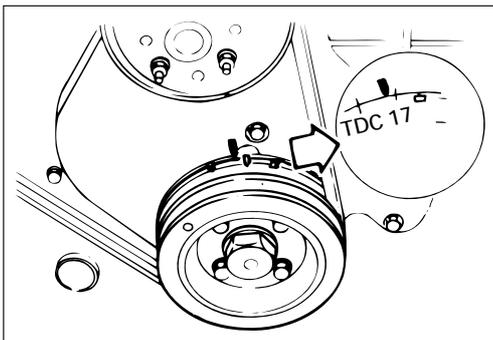
5) Operate the injection pump priming pump while slowly rotating the crankshaft until fuel stops flowing from the delivery valve holder.



6) Conform that the crankshaft damper pulley notched line is aligned with the timing gear case cover pointer.

Injection Timing (Static BTDC)

16°
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7) Remove the delivery valve holder.

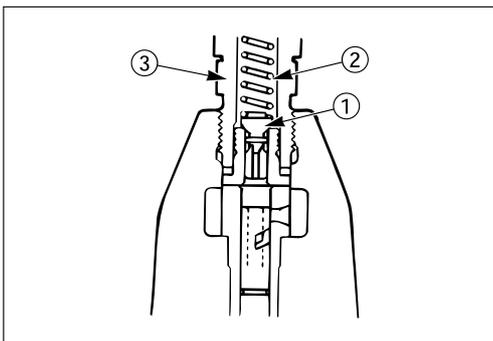
8) Install the delivery valve ①, the delivery valve spring ②, and the delivery valve holder ③.

9) Tighten the delivery valve holder to the specified torque.

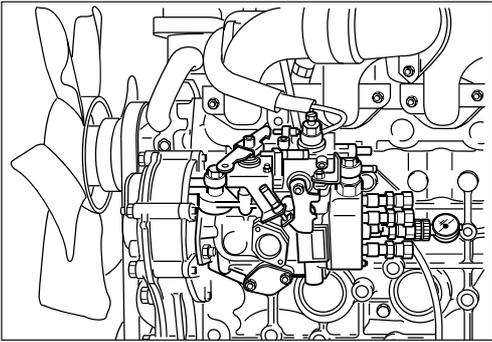
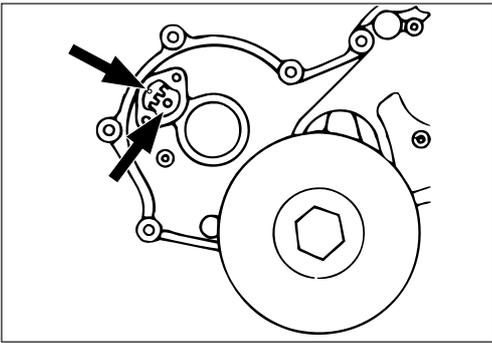
10) Install the fuel injection pipes and tighten them to the specified torque.



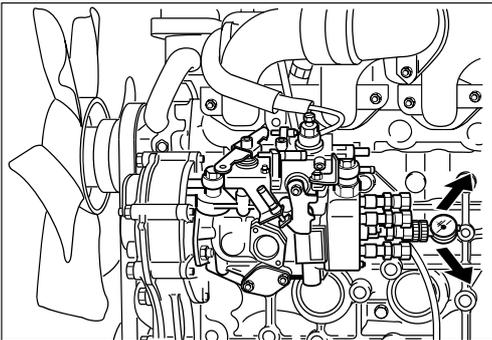
Fuel Injection Pipe Torque	N·m (kgf·m/lb.ft)
	20 – 39 (2 – 4/15 – 29)



11) Operation to air breeding.



080ES002



080ES003



**2. Distributor type injection pump**

- 1) Rotate the crankshaft clockwise to align the camshaft gear timing mark "O" with the timing gear case cover pointer.

The No. 1 cylinder will now be at the point where nearly injection timing.

- 2) Remove injector pump distributor head plug.
- 3) Fit a dial gauge and set lift to 1 mm (0.039 in).
- 4) Set crankshaft damper pulley Top Dead Center mark about 45° before Top Dead Center from the pointer.
- 5) Set dial gauge in the "0" position.

Measuring device: 5-8840-0145-0

- 6) Turn the crankshaft a little rightwise and leftwise and see if the pointer is stable in the "0" position.
- 7) Turn the crankshaft in the normal direction and read the measuring device's indication at TDC.

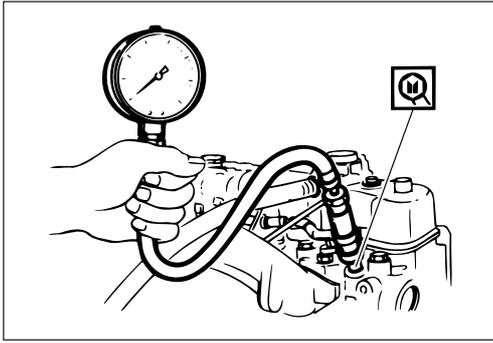
Starting Timing	mm(in.)
	0.5 (0.02)

- 8) If the injection timing is outside the specified range, continue with the following steps.
- 9) Loosen the injection pump fixing nuts and bracket bolts.
- 10) Adjust the injection pump setting angle.
  - If injection timing will be advanced, move the injection pump away from the engine.
  - If injection timing will be retarded, move the injection pump toward the engine.

Tighten the pump fixing nut, adjust bolt and pump distribution head plug to the specified torque.

Pump Fixing Bolt	N·m(kgf·m/lb.ft)
	19 (1.9/14)

Injection Pump Distributor Head Plug	N·m(kgf·m/lb.ft)
	17 (1.7/12)



### COMPRESSION PRESSURE MEASUREMENT

1. Start the engine and allow it to run for several minutes to warm it up.
2. Stop the engine and cut the fuel supply.
3. Remove all of the glow plugs from the engine.



Compression Gauge :5-8840-2675-0  
Adapter :5-8840-9029-0

4. Set a compression gauge to the No. 1 cylinder glow plug hole.
5. Turn the engine over with the starter motor and take the compression gauge reading.

Compression Pressure      MPa (kgf/cm<sup>2</sup>/psi) at 200 rpm

Standard	Limit
3.04 (31/441)	2.2 (22/313)

### RECOMMENDED LUBRICANTS

ENGINE TYPE	TYPES OF LUBRICANTS
Without turbocharger	Diesel engine oil CC or CD grade
With turbocharger	Diesel engine oil CD grade

### ENGINE OIL VISCOSITY CHART

